Older Spouses' Long-Term Relationships: Dyadic Interaction as a Resource for Cognitive Performance and Relationship Satisfaction

Thesis

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We are born into relationships,
we live our lives in relationships with others,
and when we die, the effects of our relationships survive in the lives of the living.

Ellen Berscheid (The Greening of Relationship Science, 1999)

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1 Introduction

The present thesis focuses on adaptation processes of spousal social support in couples aged 60 and older. The two main questions are in what way spousal cognitive collaboration (i.e., dyadic cognition, see chapter 1.1.1) can be seen as a resource for older couples' cognitive performance and to what extent spousal mutual emotional support (i.e., dyadic coping, see chapter 1.1.2) is a resource for older couples relationship satisfaction. Even though the focus of this thesis is on healthy couples' resources, I also briefly discuss adaptation processes in dyads confronted with severe illness. The thesis begins with a definition of the central constructs followed by an overview of the development of dyadic cognition and dyadic coping over the lifespan. Based on this summary of the current state of the art, four open questions are identified (chapter 1). These questions are addressed in the following four studies (chapter 2-5) of which study 1 reviews paradigms that have been used to study cognitive collaboration in old dyads. Study 2 is an experimental study focusing on older long-term married couples' dyadic cognition on a complex problem solving task and examining to what extent dyadic cognition is a resource for these couples' cognitive performance. Based on findings showing that cognition also depends on emotional processes (for example Blessing, Martin, Wenz, & Zöllig, 2006) and because when analyzing intimate dyads such as couples, emotional aspects demand attention, in study 3 the focus will be on the question if dyadic coping can be a resource for older couples' relationship satisfaction. Study 4 then is an extension into the field of older couples who are confronted with dementia. The paper presents a conceptual model that shows possible adaptation processes in caregiver – care receiver dyads. The last part of this thesis (chapter 6) consists of a general discussion relating the findings of the four studies to each other as well as considering methodological and practical implications and consequences for future studies.

1.1 Definition of concepts

1.1.1 Collaborative cognition

The term “collaborative cognition” is specifically describing cognitive activities with more than one person present. This cognitive activity is directed towards one or more cognitive tasks, involves collaboration, and is characterized by common goals of the interacting persons (Dixon, 1992). Collaborators are often used as external memory aids, which is why collaboration is often seen as a possibility for enhanced performance and as a compensation for age-related memory decline (that this is not necessarily the case is shown in chapter 2). People with injury- or age correlated declines of fundamental memory mechanisms (e.g., processing speed, neuronal integrity) might be able to compensate for these losses through collaboration (Dixon & Gould, 1998). For the purpose of this thesis, “dyadic cognition” will be considered to be the general term to indicate whenever two persons work together on the same cognitive task at the same time. When considering specific cognitive abilities, we may also use the more specific terms dyadic memory, dyadic planning, dyadic decision making, dyadic reasoning, or dyadic comprehension.

Next to collaborative cognition, there exist several other terms in the literature to capture the dyadic ability to solve cognitive tasks. The most influential ones in recent years have been „interactive minds” (Baltes & Staudinger, 1996) and „transactive memory“ (Wegner, Giuliano, & Hertel, 1985). Just like collaborative cognition, both these constructs see cognition mainly as a social process and, therefore, examine cognitive performances of social entities such as dyads (see Strough & Margrett, 2002). Interactive minds refers to the phenomenon that the acquisition of individual knowledge may be influenced by others’ cognition-related behaviours. This reciprocal influence can lead to a level of performance that may be higher than each individual’s level of independent individual performance. In the tradition of the interactive minds approach, social interactions during learning, problem solving, collaborative memory at old age as well as the cooperative acquisition of expert knowledge have been studied. It is interesting to note that the authors in this area have pointed out that social interactions can enhance cognitive performance and cognitive development, but that social interaction can also have negative consequences on cognitive performance (Baltes & Staudinger, 1996).

The above definitions show that it is difficult to distinguish the terms interactive minds and collaborative or dyadic cognition. Interactive minds can be seen as a more general term that is used whenever two or more people interact, whereas collaborative cognition means more specifically that two or more people solve a cognitive task together. For example the term interactive minds, is also used, when a person only thinks about what another person would do. In this case, one would not speak of collaborative or dyadic cognition.

Transactive memory theory is based on the idea that individuals can serve as external memory aids for others (Wegner, 1986). The transactive memory is a built-in structure in a relationship that is important to remember events or tasks. It goes beyond the memory of an individual (Wegner, Erber, & Raymond, 1991). For example partners in close relationships such as spouses should typically be relatively well informed about their partner's knowledge. That way both partners can profit from the couple's memory and only have to encode things that belong to their own knowledge areas. Compared to collaborative cognition which is more of a collaborative activity with a collaborative outcome, transactive memory is a memory system that allows a person to find out things by just asking a second or a third person. For example if a wife needs to know where in the household the candles are it suffices that she knows that her husband knows where they are. Simply by asking she can activate the transactive memory system. Several authors have pointed out that the use of a transactive memory facilitates collaborative memory performance. From a lifespan-perspective it can be hypothesised that old, long-term married couples are likely to have an extremely developed transactive memory system, which could help them during collaboration to cue each other more effectively than couples with a less developed transactive memory, i.e., (younger) couples with a shorter relationship history (see Andersson & Rönnberg, 1996; Hollingshead, 1998a; Wegner et al., 1991). This hypothesis will be discussed in more detail in chapter 1.2 and in chapter 2 it will be described in more detail in what situations the use of a transactive memory system influences collaborative or dyadic cognition in young and older couples.

All in all it can be said that compared to interactive minds and transactive memory, collaborative cognition is the most specific term. All three terms have in common that they refer to the idea that very often cognition is a social process and that therefore two or more people need to be considered when we look at cognitive performance outcomes.

1.1.2 Dyadic coping

Dyadic coping can be defined as the use of relationship synergies in order to cope with stress. Stress in relationships must be seen as a dyadic phenomenon and occurs when the individual coping resources of one partner or the dyadic resources of both partners do not suffice to cope with the individual or dyadic demands (Bodenmann, 2000). Stressors can come from outside the couple or can be relationship intern. Both partners can be affected simultaneously, at different times or directly after each other (one partner cannot cope with stress, which again is a stressor for the other partner). Bodenmann (2000) differs between individual stress concerning one partner, individual stress concerning both partners independently, individual stress concerning both partners, but to a different extent, and genuine dyadic stress that concerns both partners comparably. Situational factors (for example relationship conflicts), personal factors (for example personality, health problems, dysfunctional individual coping), dyadic factors (for example role definition, regulation of closeness and distance, communication or dyadic coping deficits), and external factors (for example critical life events, economic situation) can be sources of stress.

Dyadic coping is a process in which partner A sends out stress signals, which are noticed and reacted on by partner B. Stress communication can be problem-centered (I ask my partner to carry out a task for me when I feel stressed) or emotion-centered (I tell my partner when I'm stressed that I need her emotional support). Dyadic coping can be positive or negative and again problem-centered or emotion-centered. Subcategories of positive dyadic coping are common dyadic coping (both partners try to cope with internal or external stress together), supportive dyadic coping (one partner supports the other in his coping efforts, which can be interpreted as an integration of social support and coping (see also Cutrone & Suhr, 1992; Thoits, 1986; cited in Bodenmann, 2000)), and delegated dyadic coping (is always problem-centered and the stressed partner delegates tasks to the partner). Negative dyadic coping can be divided into the subcategories hostile dyadic coping (hostile reaction to the partner's stress communication), ambivalent dyadic coping (partner's support is unmotivated), and withdrawal-behaviour.

1.1.3 Relationship quality, relationship satisfaction, and relationship stability

Lewis and Spanier (1979) define relationship quality (marital quality) as a subjective evaluation of the relationship or marriage as good, happy, or satisfying on the basis of structural

factors of the relationship or marriage like interaction, communication, satisfaction with the relationship, cohesion, and sexuality. In the English speaking literature the term relationship quality often comprises the term relationship satisfaction, which is defined as the subjective experience of satisfaction and happiness with the relationship or marriage. Factors like communication, love, appreciation, affectivity, and sexuality are important (Jäckel, 1980; Terman, 1938; cited in Bodenmann, 2000). The term relationship stability (marital stability) is more objective and means the duration of a relationship or marriage. Of course, relationship quality and relationship satisfaction are important determinants of the stability of a relationship. However, having a stable relationship does not mean automatically being satisfied with it. There are couples that stay together even though they do not get along well and there are also couples that give up the relationship even though they are happy with it.

Throughout this thesis the terms relationship satisfaction as well as relationship quality will be used equally whenever a partner's or both partners' subjective evaluation of their relationship or marriage as more or less satisfying is meant. Even though in this thesis only married couples were included, I will use both terms, relationship (quality, satisfaction) and marital (quality, satisfaction).

1.2 Dyadic cognition and dyadic coping over the lifespan

This chapter has two main goals. First, it will be demonstrated why a lifespan perspective on dyadic cognition and dyadic coping is interesting and important. In the same paragraph similarities and differences between the two concepts will be shown. Second, I will report the actual state of the art in both research areas.

In both research traditions, there is a clear focus on young dyads or couples and only very few studies have used older adults' dyadic interactions as the unit of analysis. At this point, it is important to note that as opposed to dyadic cognition research, dyadic coping research only looks at married dyads (or non married couples). Whereas it makes sense to analyze stranger dyads, co-worker dyads, and married dyads cognition with regard to cognitive performance, dyadic coping can only be meaningfully examined in intimate dyads (i.e., married and non married couples). In addition to the focus on young dyads, in the field of dyadic coping and relationship satisfaction, the focus is on short-term relationships or marriages, which again is a consequence of the young age of study participants. Long-term relationships have received little

attention. However, in the next decades, the number of old people in general and old couples who have been married for a long time or old couples who have been living together for a long time will rise. In fact, in Switzerland at the time of retirement 75% of women and 80% of men still live together with their spouses, and one third of the 80-year-olds are still married. In addition, women aged 65 on average still live 15 more years with their partner (Swiss Federal Statistical Office, 2005). In Germany from 1996 to 2005 the proportion of old couples rose from 8% to 27% for husbands and from 6% to 21% for wives (German Federal Statistical Office, 2000). This increase in life expectancy and relationship duration makes it important to analyze possible resources that can enhance older adults and couples' life quality.

Dixon and Gould (1998, p. 161) state, that dyadic cognition is an "often-overlooked context of cognitive potential for older adults". And this, even though dyadic cognition occurs frequently in different contexts of everyday life (work, family, leisure time, friendship) between different dyads (strangers, couples, co-workers, friends, family) and has the potential to be a resource for older adults cognitive performance. The latter is particularly important for older dyads, because there is persuasive empirical evidence for aging-related decline in cognitive performance on a variety of cognitive functions (e.g., Blanchard-Fields & Hess, 1996; Craik & Salthouse, 1992) and because aging in general is often described as a succession of losses (Johansson, Andersson, & Rönnberg, 2005). Baltes (1997) theory about the limitations older people often have to face, involves three main processes: (1) selection, (2) optimization, and (3) compensation. When old people get weaker it is necessary for them to select manageable goals, optimize still possible functions, and compensate for no longer available means by other means. Dyadic cognition can be one method to compensate for memory decline in old age (Johansson et al., 2005). Assuming that intact cognitive ability is associated with better health (Schonemann-Gieck et al., 2003), as well as with an autonomous, successful, and satisfying aging process (Baltes, Mittelstrass, & Staudinger, 1994), it is important to analyze the circumstances under which dyadic cognition leads to an enhancement of cognitive performance.

As mentioned above, a similar neglect of research as on older adults' dyadic cognition can be seen in the literature on dyadic coping and relationship satisfaction. This, even though long-term marriages in middle and old adulthood are the most common form in the United States and Europe (Gagnon, Hersen, Kabacoff, & Van Hasselt, 1999; Vaillant & Vaillant, 1993) and even though for older couples in long-term relationships the importance of the partner as a

source of social support might be even more important than for younger people for several reasons. First, retirement, relocation, and death of friends and family can lead to a narrowing of social networks, which again can increase the importance of the partner as a source of social support. Second, health problems of older adults might also limit access to other social support systems (Gagnon, Hersen, Kabacoff, & Van Hasselt, 1999). Third, after a long time of professional life and raising children, there is a stronger focus on the couple relationship again (Kruse, 1992) and forth, because emotion regulation is of high importance to older people, they might prefer to spend time with well-known social partners like one's husband or wife (with them emotions are predictable and more positive; Carstensen, 1992). Another reason why dyadic coping and relationship satisfaction are of special importance for older adults is the association between relationship satisfaction and health that has been found in young adults. Studies have shown the predictive value of dyadic coping for relationship satisfaction (Bodenmann, 2000) and other findings suggest a strong association between relationship satisfaction and different health outcomes (mental and physical health, mood, social integration, subjective well-being; (Diener, Gohm, Suh, & Oishi, 2000; Horwitz, White, & Howell-White, 1996). Assuming older adults' being at particular risk for the above mentioned health problems shows the importance of research on relationship satisfaction and its predictors.

In summary, higher life expectancy and the fact that in general there is very little research on older dyads and long-term married couples as well as the possibility of dyadic cognition and dyadic coping being resources for older dyads' and couples' cognitive performance and relationship satisfaction, makes research in this field highly important. The above explanations show that even though dyadic coping and dyadic cognition are two very distinct terms, they have in common that they can both be important resources for older dyads and couples. In case of a stressor being a cognitive problem, dyadic cognition could even be the ideal form of dyadic coping. As already mentioned, dyadic cognition can also happen between strangers, i.e. between all kinds of dyads that solve cognitive problems together, where as the term dyadic coping has been only used in the context of intimate relationships (married and not married mostly heterosexual couples).

Even though dyadic cognition might be a resource for older dyads' cognitive performance, one cannot say that working together as a dyad is always effective. Effective collaboration depends on individual efforts, the task itself, and the goal of the two persons.

Groups and dyads usually do perform better than individuals, but there is a controversy whether and when groups perform optimally. For Berg, Johnson, & Meegan (2003, p. 34) „the diversity present in collaborative cognition is important to understand what characteristics make two heads better than one". A group or dyad performing optimally means that a groups' or a dyads' performance is better than nominal performance of the group members, i.e., the pooled, non-redundant performance of two individuals (also the predicted potential of a group). For a successful collaboration of groups (collaborative cognition) and dyads (as mentioned above, in this thesis the collaboration of dyads is called dyadic cognition), on the one hand, it is important to reduce process losses (groups and dyads are less effective than would be expected from individual performances and resources), coordination losses (inability to integrate individual resources of group members), production blocking (while waiting for others to finish their speech, a group member forgets his own idea), and motivation losses (motivation decline because of social loafing, i.e., reason for motivation loss is that own contribution cannot be identified in the group). On the other hand, familiarity and the use of a transactive memory are factors that can positively influence collaboration. Studies with young and older adults show that married couples' collaboration is usually more successful than stranger dyads' collaboration and that the use of a transactive memory (see chapter 1.1.1) also has a positive effect on collaboration outcome. In chapter 2 it will be discussed in more detail when dyadic cognition enhances cognitive performance.

Several studies have pointed out that dyadic coping is strongly related to couples' relationship satisfaction (mainly young couples). It has been shown that dyadic coping is associated with relationship quality by two mechanisms (Bodenmann, 2005): On the one hand, dyadic coping reduces the negative influence of stress on the relationship, which is a moderating effect. On the other hand, through dyadic coping efforts, partners perceive their relationship as supportive, which leads to more mutual trust, intimacy, and solidarity between partners. Several studies (see Bodenmann, 2000) using the dyadic coping questionnaire FDCT-N (Bodenmann, 1990, 1998) and different relationship satisfaction questionnaires show middle to strong correlations between the two variables dyadic coping and relationship satisfaction (r = .44 for the dyadic adjustment scale, Spanier, 1976; r = .57 for the PFB-relationship questionnaire, Hahlweg, 1996; r = .61 for the marital needs satisfaction scale, Stinnett, Carter, & Montgomery, 1970; r = .67 for the relationship assessment scale, Hendrick, 1988). In a meta-analysis, Bodenmann

(2000) finds correlations from $r = .32$ ($p < .05$) to $r = .63$ ($p < .001$) between the total dyadic coping score and the total relationship satisfaction scores of young and middle aged couples ($g = 1.21$). On a subscale level, the highest correlations were found between supportive dyadic coping (e.g., "she gives me the feeling that she understands me and my problems") and common dyadic coping (e.g., "if something bothers both of us, we usually try to solve the problem together and look for a solution together") respectively, and relationship satisfaction (correlations up to $r = .62$). Results of multiple regression analysis demonstrated that 71% of the variance of wives' relationship satisfaction could be explained by their own self-rated dyadic coping, whereas husband-rated dyadic coping only explained 36% of wives relationship satisfaction. Similar results were found for husbands' relationship satisfaction, where their self-rated dyadic coping explained 65% of variance and the partner-rated dyadic coping explained 36% of variance. In a longitudinal study over two years it was shown that relationship satisfaction was higher in couples with more stress communication, more positive dyadic coping (self-rated and partner-rated), less negative dyadic coping (self-rated and partner-rated), and more common dyadic coping (Bodenmann, Pihet, & Kayser, 2006). In a five year longitudinal study, it was shown that couples with a high relationship satisfaction score after five years had significantly higher emotion-centered supportive dyadic coping and common dyadic coping scores (emotion- and problem-centered) than unhappy couples.

Concerning older adults' coping, it is unclear if older people use more mature (humor, sublimation; see Vaillant, 1977, cited in Bodenmann, 2000) or more primitive strategies (fear, withdrawal; see McCrae, 1982, cited in Bodenmann, 2000). Contrary to findings on cognitive performance that decreases with age and similar to heterogeneous theories on dyadic coping over the lifespan, there exist different results on the development of relationship satisfaction over the lifespan. Results from mainly cross-sectional studies suggest a U-shaped curve in marital satisfaction level (e.g. Spanier & Lewis, 1980) where as longitudinal studies have found that older couples' marital satisfaction slowly decreases with age. In the first few years a rapid decrease can be noticed – in the following years the satisfaction level either slowly further decreases or remains stable (e.g. Van Laningham, Johnson, & Amato, 2001).

In one of the few studies on predictors of older couples' marital satisfaction, Kaslow and Robison (1996) analyzed factors that led to long-term happy marriages (couples were married between 25 and 46 years). Happy couples' individuals showed positive communication strategies

and perceived their partners as good listeners. Supportive behaviors and positive interactions were highly important factors for long-term, satisfying relationships. Levenson, Carstensen, and Gottman (1993) demonstrated that compared to middle-aged marriages, older couples showed a reduced potential for conflict and more sources of pleasure. The association between conflicts and relationship satisfaction was stronger than the relation between sources of pleasure and relationship satisfaction. Schmitt, Kliegel, and Shapiro (2007) showed with data from 588 married individuals in middle and old age that a high quality of dyadic interaction was the strongest predictor for marital satisfaction (particularly for women). Socio-economic factors and personality played a minor role in predicting marital satisfaction. In a study with three age groups (young, middle aged, old), Bodenmann (1998) found significant correlations between dyadic coping and relationship satisfaction for all age groups.

The above results show that it remains largely open to what extent dyadic cognition can be a resource for older dyads' and couples' cognitive performance and to what extent older couples' dyadic coping is a resource for their relationship satisfaction. The following chapter presents the four main research questions of this thesis and in the consecutive four studies then address these open questions.

1.3 Research questions

The first and second research questions aim at a better understanding of dyadic cognition in old age. Whereas the first study reviews current paradigms and findings in the literature on older adults' dyadic cognition, the second study is an empirical study investigating if older, long-term married couples profit from dyadic cognition on a complex problem solving task. By using a within-subject design with long-term married couples who individually and in the dyad solve a problem solving task, the second study fills in gaps that have been pointed out in the literature review in chapter 2. The third research question addresses the topic of older couples' dyadic coping and their relationship satisfaction. Study 3 goes away from older couples' cognition and focuses on emotional aspects of intimate relationships in old age and therefore, individual and dyadic perspectives on the association between dyadic coping and relationship satisfaction in older spouses will be examined. The forth study presents an extension into clinical psychology and suggests a model that explains adaptation processes in older spousal caregiver – care receiver dyads in the context of dementia. These four research questions are addressed by four

different methodological approaches. As already mentioned, the first study is a review of current finding in the field of dyadic cognition on old age. In the second study an experimental design was used whereas the third study was questionnaire-based. The forth study is a theoretical paper that engages in explanatory mechanisms and suggest a model of dyadic adaptation in case of severe illness of one partner. While the strengths of the literature review are the presentation of the current state of the art and the identification of research implications (amongst others for study 2), the advantage of the experiment in study 2 is the controlled, standardized, and highly structured setting. However, the questionnaire-based study 3 with the disadvantage of questionnaires being subjective, allowed us to collect relatively much data (138 long-term married couples) in a short period of time. The theoretical model in study 4 has the advantage of pointing out new hypothesis that can be addressed in future research. The methodological advantages and disadvantages of the specific studies are discussed in more detail in the discussion parts at the end of the studies and as well in the general discussion at the end of this thesis (chapter 6).

2 Study 1

2.1 Dyadic cognition in old age: Paradigms, findings, and directions [1]

2.1.1 Introduction

This chapter gives an overview on the current state of the art in the field of older dyads' collaborative cognition as a resource for their dyadic cognitive performance as well as summarizing paradigms that have been used to study dyadic cognition. Even though the focus of this thesis lies on older married dyads, i.e. older couples, it is important to also look at for example "stranger" dyads collaborative cognition, when one wants to learn about familiar or married dyads cognition. Therefore, findings from studies examining paradigms that have been used to study cognition in old dyads, i.e., pairs of persons both 60 years or older, are reviewed. Overall, this review has three main goals. We focus on (a) paradigms that have been used to examine dyadic cognition in old age, (b) performance differences in dyadic cognition, and (c) explanatory concepts for performance differences such as relationship characteristics, dyadic versus individual performance, age, gender, training, and communication patterns. Finally, we will make recommendations for future paradigm development and research directions.

As mentioned above for the purpose of this review, we will consider dyadic cognition to be the general term to indicate whenever two persons work together on the same cognitive task at the same time. When considering specific cognitive abilities, we may also use the more specific terms dyadic memory, dyadic planning, dyadic decision making, dyadic reasoning, or dyadic comprehension. We consider dyadic cognition paradigms when, at least in principle, they allow to obtain information about the product and the process of particular dyadic cognitive abilities and performances. Although a number of studies with younger dyads have used cognitive tests to manipulate the amount of stress (e.g., Bodenmann, 2000) and examine dyadic responses to stress (e.g., Bodenmann, 1995; Bodenmann & Cina, 1999; Bodenmann & Widmer, 2000; Bodenmann, Pihet, Cina, Widmer, & Shantinath, 2006) or the relation between cognitive abilities and ratings of emotional well-being (e.g., Kolanowski, Hoffman, & Hofer, 2007), we focus on papers that

[1] A similar version of this chapter has been published in the "Handbook of cognitive aging: Interdisciplinary perspectives" (Martin & Wight, 2008)

have been examining dyadic cognition in old age and where the dependent variable of interest was cognitive performance. This means that at least one outcome measure in the included studies had to be cognitive performance of an older dyad.

2.1.2 Paradigms to examine dyadic cognition

To examine the relevance of dyadic cognition as a possible resource for cognitive performance, experimental paradigms need to fulfil some essential requirements: Paradigms should be appropriate to use with individuals and dyads covering a wide age range, gender differences and hierarchy differences. Paradigms should also allow repeated measurement. This way, paradigms can be used in married couples versus professional dyads or unfamiliar dyads, in age comparisons, in comparisons between individual versus dyadic performance, and in longitudinal studies. From an experimental point of view, paradigms should allow to manipulate the causal mechanisms suspected to influence dyadic performance. When examining existing paradigms, we will therefore determine to which degree existing paradigms fulfil these criteria and which areas might need additional paradigm development.

2.1.3 Dyadic memory

Dyadic memory paradigms. In the literature on old peoples' dyadic cognition, dyadic memory has been studied most often. This is probably due to the idea that collaborating on a memory task may compensate for age-related individual losses in memory performance. In fact, several memory studies with young adults show that young individuals can gain by collaborating on memory tasks (Dixon, 2000; Dixon & Bäckman, 1995; Dixon, Fox, Threvithick, & Brundin, 1997; Dixon, Gagnon, & Crow, 1998; Finley, Hitch, & Meudell, 2000; Stephenson, Kniveton, & Wagner, 1991). However, relatively little is known about old adults' performance in dyadic memory. Generally, the paradigms that have been used to examine old dyads memory performance are similar to paradigms examining individual memory performance (for an overview, see Table 1. They reach from recognition for verbal material over recall for verbal and spatial material, to prospective memory, and include typical laboratory tasks as well as tasks using materials familiar from or similar to everyday life.

Table 1: Studies examining old adults' dyadic memory

	Dixon & Gould, 1998	Gould, Lee, & Dixon, 1991	Gould & Dixon, 1993	Gould, Kurzman, & Dixon, 1994	Gould, Osborn, Krein, & Mortenson, 2002	Johansson, Andersson, & Rönnberg, 2000	Johansson, Andersson, & Rönnberg, 2005	Ross, Spencer, Linardatos, Lam, Perunovic, 2004
Paradigms	Story recall	Story recall	Vacation description	Story recall	1. Story recall 2. Word recall 3. Referential naming task	1. Prospective event and time based tasks 2. Verbal and spatial information recall	1. Episodic memory task (questions about stories) 2. Semantic memory task (questions about famous places etc)	1. Verbal recognition 2. Item recall from shopping list
Sample	**Experiment 1:** 84 young, unacquainted adults (**M** age = 24.4) and 84 old, unacquainted adults (**M** age = 67.9). **Experiment 2:** 10 young (**M** age = 29.4; **M** marriage = 3.02) and 10 old (**M** age = 71.6; **M** marriage = 40.15) couples	84 young, unacquainted adults (**M** age= 24.4) and 84 old, unacquainted adults (**M** age= 67.9)	10 young couples (**M** age=28.5; **M** marriage= 3) and 10 old couples (**M** age= 70.7; **M** marriage= 40)	20 young dyads (**M** age = 26.30) and 20 old dyads (**M** age = 69.52). Half unacquainted, half couples (**M** marriage young = 3; **M** marriage old = 40)	30 young couples (**M** age= 26; **M** marriage = 4) and 30 old couples (**M** age = 67.4, **M** marriage = 44). Worked either with spouse or unfamiliar other gender partner first	20 married couples (**M** marriage= 46.5), 19 arranged pairs, 36 control persons (**M** age= 73)	62 couples (**M** age= 73; **M** marriage= 43)	29 married couples in collaborative condition, 30 married couples in individual condition (**M** age = 72.8; **M** marriage = 45.04)
Different couples (age, familiarity, gender etc)	Yes. Experiment 1: Young, old, unfamiliar, same-sex Experiment 2: Young and old couples	Yes. Young, old, unfamiliar, same-sex	Yes. Young and old	Yes. Young, old, married, unacquainted	Yes. Young, old, married, unacquainted	Yes. Married and unacquainted	No. Married and nominal pairs	No
Within-subjects-design	No	No	No	No	Yes and no. Same people in dyads and couples.	No	Yes. Married couples tested in dyads and individually	No

Causal mechanisms suspected to influence performance	Experiment 1: Age, individual versus dyad Experiment 2: Age, predictions, postdictions	Age, elaboration characteristics such as denotative and annotative elaborations	Age differences in story structure, story content, interactions of collaborators	Age differences in story-based productions, task discussion, sociability/support productions	Age, familiarity, tasks	Dyad versus individual, tasks, transactive memory	Dyad versus individual versus nominal pairs, Responsibility, agreement	Dyad versus individual, Expertise
Individual and dyadic measurements	Experiment 1: Yes Experiment 2: No	Yes	No	No	No	Yes. Individual scores used for nominal pairs	Yes. Individual scores used for nominal pairs	Yes
Measurement of relationship indicators	Experiment 1: No Experiment 2: Couples' expertise questionnaire (no age difference in knowledge about one's partner)	No	No	No	No	Transactive memory questions	Responsibility and agreement	No

Dyadic memory paradigms: Performance or process differences. Summarizing the results of the few studies on dyadic memory tasks is difficult, because the studies focus on different aspects of old dyads' collaborative memory performance. However, three aspects of dyadic memory in old age have received particular attention. First, with respect to dyadic performance most studies with old adults report that dyadic performance is superior to individual memory performance (Dixon & Gould, 1998; Johansson et al., 2000; Johansson et al., 2005; Ross et al., 2004). That is, one individual trying to recall items or a story will perform worse than two people working jointly on the same task. This result is the same for naturalistic tasks such as remembering items from a shopping list and typical laboratory tasks, such as word or story recall. When comparing dyadic memory performance to nominal group performance, i.e., the pooled, non-redundant performance of two individuals, real dyads typically perform worse than nominal dyads (Andersson & Rönnberg, 1995; Basden, Basden, Bryner, & Thomas, 1997; Johansson et al., 2000; Johansson et al., 2005; Ross et al., 2004). However, this is only true for episodic memory, but not semantic memory. This means that semantic tasks are not negatively affected by collaboration. A difference in the process of achieving memory performance seems that real dyads generate fewer correct answers, but they also make fewer mistakes than nominal pairs (Johansson et al., 2000).

Second, and for the purpose of this thesis, especially interesting, one may wonder if old familiar dyads such as married couples perform better on memory tasks than unacquainted pairs. Here, the findings are inconclusive. Whereas Dixon and Gould (1998) report such a familiarity effect on story recall tasks, other studies (Gould et al., 2002; Johansson et al., 2000) found no or only small advantages of familiarity on retrospective verbal tasks, spatial memory tasks, and prospective memory tasks (Johansson et al., 2000). When married couples indicate that they use a transactive memory system, performance levels can be as high as nominal pair performance (Johansson et al., 2005).

Third, studies of dyadic cognition in old age typically compare old adults' collaborative memory performance to young adults' collaborative performance. For this comparison, different results have been reported. Some studies find no story recall performance differences between young and old married couples (Dixon and Gould, 1998), and other studies do report performance differences between old and young married couples (Gould et al., 2002). However, differences in the structure, the content, and the interaction when recalling an experienced event

have been observed (Dixon & Gould, 1998; Gould et al., 1994). Important age differences were found in the referential naming task (Gould et al., 2002), with old dyads communicating less efficiently than young dyads. A reason for this result could be that old adults focus on reducing errors instead of increasing efficiency, i.e., they verify and re-verify their viewpoints more often to accomplish the task with as few errors as possible. In addition, Gould and Dixon (1993) found that story structure, content, and interaction style differ between old and young married couples when recalling a jointly experienced event. Old adults' strategy of using more words and speaking more slowly could possibly be explained by old adults' word-finding difficulties (Gould & Dixon, 1993). Fewer supportive words from old adults as well as more monologues might be explained by old adults' strategy to decrease the memory demands of the task and the cognitive demands of collaboration (Gould & Dixon, 1993).

Interdyadic differences in memory: Explanatory concepts. In most tasks mentioned in Table 2, causal mechanisms suspected to influence performance are collaboration, age, and familiarity. What has been examined as potential causes underlying the interdyadic differences in memory performance are familiarity of the dyadic partners (married versus unacquainted, length of relationship, general dyadic collaboration expertise), closeness of task to everyday experience, communication style (number of words used, number of turns taken), strategy differences (use of transactive memory, division of responsibility, readiness to risk errors, reduction of memory load through monologues), dyadic agreement, intradyadic responsibility distribution, metacognitive skills, memory self-efficacy, age- and gender-typical communication styles (willingness to interrupt, formal versus informal communication), individual memory skills of partners, interference of individual encoding with partner's explicit encoding, and need for contextual support. Again, the emerging picture is inconclusive. Whereas familiarity, operationalized through comparing married with non-married couples, did play a role for some areas such as story recall (Dixon & Gould, 1998), it did not affect performance in a referential naming task (Gould et al., 2002). The effect of familiarity may be explained by old couples being experts at working together, meaning that they have excellent knowledge of each other's cognitive skills and knowledge as well as having practice in all kinds of collaborative situations (Dixon & Gould, 1998). Also, old couples might have experienced individual cognitive decline and might be more motivated to compensate for those losses by collaboration than young couples (see also Blanchard-Fields, Horhota, & Mienaltowski, 2008). Yet another explanation might be the

considerable collaborative metacognitive skills (pre- and postdictions) old couples show (Dixon & Gould, 1998). Their accuracies follow a pattern similar to patterns of young individuals or young couples, suggesting that old couples are dyadic collaboration experts. When more specifically the intradyadic agreement and distribution of responsibilities were examined, there are indications that these factors can contribute to best possible performance of old dyads, probably because the division of responsibility reduces the required amount of inhibition and enhances the effort the individual puts into the task (Johansson et al., 2005). Responsibility and agreement did not influence dyadic performance on the semantic task, because no new information needs to be encoded and, therefore, information overload for the individual is not a problem.

Ross et al.'s (2004) result that collaborating dyads make fewer mistakes than nominal dyads can be explained by false positives being unique to each person and therefore make it unlikely that one's partner has the exact same wrong memories. This suggests that collaboration can counteract the effects of aging on source monitoring. The reduction of false positives (chose item that was on original list, but not on personal shopping list or chose item that is on no list, but is in the supermarket) in collaborative remembering can be very important, because old people tend to have wrong memories more often than young adults. Empirical findings do support the importance of the readiness to risk errors and the age- and sex differences in communication styles, even when no performance differences could be observed.

A limitation of the existing approaches is the difficulty to compare individual and dyadic performance in a within-subjects design, the lack of individual ability measurements, and the lack of experimental manipulation of the explanatory variables (study 2 of this dissertation considers these three problems). In fact, most studies use between-dyads designs, age is often taken as a proxy for a general decline in memory performance, and explanatory variables are mostly examined through questionnaires. Therefore, the power to detect effects is smaller than in typical experimental paradigms. This suggests that ideally experimental paradigms applied within a within-dyad design may help to disentangle the factors contributing to age- and interdyadic differences in dyadic cognition. Although it may be argued that most of the existing paradigms might be used for this purpose, more empirical evidence from experimental within-dyad designs, demonstrating feasibility and adequate measurement properties, is clearly needed. The measurements of relationship characteristics also need more attention in future old dyads'

memory research. Transactive memory, degree of responsibility and agreement, and couples' expertise, i.e., how well the partners know each other, have been analyzed with a few tasks, but deeper understanding of these and other characteristics are needed to better understand dyadic memory in old age.

2.1.4 Dyadic planning

Dyadic planning paradigms. Old dyads' planning has not received much attention in the literature. Only three studies consider old dyads planning abilities, and planning typically appears under the heading of everyday problem solving. In these studies, dyadic planning focuses on errand planning and trip planning.

Table 2: Studies examining old adults' dyadic planning

	Berg, Johnson, Meegan, & Strough, 2003	Cheng & Strough, 2004	Margrett & Marsiske, 2002
Paradigms	Errand planning	Trip planning	Errand planning
Sample	6 young (**M** age= 29.7) married couples	24 young women, 24 young men (**M** age = 19.98), 25 old women and 24 old men (**M** age = 71.14) worked either alone or with same-sex friend	98 old married couples (**M** age = 72.90; **M** marriage = 45.81), each participant (196) completed task independently and in dyads (52 with spouse, 46 with stranger of opposite sex)
Different couples (age, familiarity, gender etc)	Yes. Young and old couples	Yes. Young, old, same-sex, familiar dyads	No. Just old couples
Within-subjects-design	No	No	Yes and no, same task individually and in dyads, but half with spouse and other half with stranger
Causal mechanisms suspected to influence performance	Age differences in interaction style. Coding into high-affiliation and low-affiliation interactions	Age, collaboration	Collaboration, gender, and familiarity (actor –partner method), collaborative as well as task specific expectations, evaluations, and competitiveness
Individual and dyadic measurements	No	Yes	Yes
Measurement of relationship indicators	High and low-affiliation interactions	No	Open-ended interview to find out about daily collaboration

Dyadic planning paradigms: Performance or process differences. The few studies looking at old adults' dyadic planning abilities have focused on dyadic versus individual performance and on the comparison of old and young dyads. Familiarity aspects have not received much attention on planning tasks, but instead some studies have looked at sex differences (Cheng & Strough, 2004; Margrett & Marsiske, 2002) and relationship characteristics (Berg et al., 2003). Unlike for the memory tasks, for planning tasks differences between individual performance and dyadic performance and differences between old and younger dyads are not very clear. Cheng and Strough (2004) found that young adults planned faster and more accurately than older adults, but no age differences were found on most of the primary performance measures. When old adults were instructed to pay attention to important aspects of the planning task, they were able to perform as well as young adults. Berg et al. (2003) expected that old couples would show less low affiliation interactions than younger couples, because of the less conflictual nature of long-term marriages (Carstensen, Isaacowitz, & Charles, 1999). Surprisingly, however, there was no difference between young and old couples in how they interacted. However, Berg et al. (2003) found that independent of the dyads' age, collaboration characterized by high affiliation was associated with shorter routes on the errand-running task. Thus, interaction characteristics seem to be important when we look at collaboration outside of the laboratory in everyday life.

Comparing collaborators and individuals, Cheng and Strough (2004) did not find differences on most of the performance measures, even though collaborators make fewer planning mistakes than individuals (cf. dyadic memory research). Differences between the planning task in this study and the memory tasks used in other studies might explain the different results when it comes to collaborative performance. The studies that found collaborative performance to be superior to individual performance used memory tasks such as story recall (Dixon & Gould, 1998) and remembering digits (Dixon, 1992).

If sex differences in dyadic planning exist remains unclear, because one study (Cheng & Strough, 2004) has found women to perform worse on planning tasks than men and one study has not found sex differences (Margrett & Marsiske, 2002). It is interesting to note that even though Margrett and Marsiske (2002) do not find sex differences on planning performance, they do find that men are more influential, i.e., more likely to use their own judgement to influence their own collaborative outcome on the planning task in the collaborative situation.

Interdyadic differences in planning: Explanatory concepts. The fact that collaborating dyads did not outperform individuals on most performance measures (Cheng & Strough, 2004) of trip-planning may be explained by the relatively low memory demands of the task. Participants were allowed to use external memory aids such as maps, instructions, and daily itineraries. In the dyadic memory tasks that found an advantage of collaboration, memory demands were higher and therefore collaboration is more likely to enhance performance (Cheng & Strough, 2004).

Married couples interaction styles were related to cognitive planning performance (Berg et al., 2003). Constructive elaborations, explorations of the situation, and initiation of joint action instead of commanding, rejecting, and resisting others led to better planning. Berg et al. (2003) state that this finding is consistent with findings reported in the child development literature (Rogoff, 1998; quoted in Berg et al., 2003). One explanation for the worse performance of low-affiliation couples is that they often made two individual plans for the errands. Berg et al. (2003) suggest that these couples find collaboration aversive and try to avoid it in daily life.

Overall, planning seems to be of enormous importance to cope with the changing demands of everyday life of old dyads. The studies reviewed are inconclusive with respect to the factors contributing to optimal planning performance in the laboratory and in everyday life. Clearly, more studies on elderly dyads planning abilities are needed. Within-dyad designs as well as larger sample sizes would help to better understand which mechanisms influence dyadic planning performance in old age.

2.1.5 Dyadic decision making

Dyadic decision making paradigms. Margrett and Marsiske (2002) as well as Berg et al. (2003) also used decision making tasks in the studies mentioned above. Another approach to examine decision making in old dyads stems from the wisdom tasks used by Staudinger and Baltes (1996). Again, only very few studies about dyadic decision-making in old age exist, and they have used very different types of tasks. While wisdom and social dilemma tasks require social competence, the vacation decision making is a decision-making task in the traditional sense (see Table 3).

Table 3: Studies examining old adults' dyadic decision making

	Berg, Johnson, Meegan, & Strough, 2003	Margrett & Marsiske, 2002	Staudinger & Baltes, 1996
Paradigms	Vacation decision making task	Social dilemmas	Wisdom paradigm
Sample	6 young (**M** age = 29.7, **M** marriage = 5.5) and 6 old (**M** age = 70.8, **M** marriage = 41.2) couples	98 old married couples (**M** age = 72.90; **M** marriage = 45.81), each participant (196) completed task independently and in dyads (52 with spouse, 46 with stranger of opposite sex)	122 participants with partners. Total 244 participants (148 women, 96 men). Half young adults (20-44) and half older adults (45-70)
Different couples (age, familiarity, gender etc)	Yes. Old and young married couples	No. Only old couples	Yes. Young and old adults with partners brought along
Within-subjects-design	No	Yes and no, same task individually and in dyads, but half with spouse and other half with stranger	Yes and no, same task individually and in dyads, but half with young and half with old dyads
Causal mechanisms suspected to influence performance	High- and low-affiliation interactions	Collaboration, gender, and familiarity (actor –partner method), collaborative as well as task specific expectations, evaluations, and competitiveness	1. External dialogue plus individual appraisal 2. External dialogue 3. Internal dialogue 4. Unconstrained individual thinking time 5. Standard: individually
Individual and dyadic measurements	No	Yes	Yes
Measurement of relationship indicators	High-and low affiliation interactions	Open-ended interview to find out about daily collaboration	Questions about relationship with person, who they interacted with

Until now only three studies on old adults' dyadic decision-making exist. Most of the paradigms do not fulfil the criteria that would allow a wider use in empirical research or comparisons of results between studies. Small sample sizes (Berg et al., 2003) and the lack of within-subject studies, make comparisons between old and young dyads as well as between collaborative and individual performance difficult. Margrett and Marsiske (2002) and Staudinger and Baltes (1996) allow with their tasks a comparison between individual and dyadic performance, but not between familiar and unfamiliar and old and young dyads. Comparable to the dyadic planning tasks, Berg et al. (2003) were interested in how relationship characteristics influenced dyadic performance and coded speech acts into low and high affiliation interactions. Margrett & Marsiske (2002) asked about couples' daily collaboration. Staudinger and Baltes (1996) varied five causal mechanisms to find out how collaboration can be most effective. Individual and dyadic measurements are possible in all three decision-making tasks and relationship indicators are measured by all three paradigms.

Dyadic decision making paradigms: performance or process differences. In sum, three studies have looked at old adults' dyadic decision-making (Berg et al., 2003; Margrett & Marsiske, 2002; Staudinger & Baltes, 1996). The focus of the three studies is on differences between individual and dyadic decision-making, on age differences when it comes to making decisions, and on sex differences as well as relationship characteristics. Important relationship or communication characteristics for making optimal decisions are high- or low-affiliation interactions. High-affiliation interactions were associated with better decision-making strategies. This pattern of high-affiliation interactions being related to searching more information on the particular features of the potential solutions instead of information allowing a fast exclusion of particular alternatives is congruent with the idea that for feature-based decision strategies couples need to agree on which features are most important instead of just agreeing on the final choice. Again, affiliation did play a role for dyadic performance, but no age effects were found. The expectation that because of more high-affiliation interactions old dyads would be better at collaborative decision- making was not supported (Berg et al., 2003).

Margrett and Marsiske (2002) examined sex differences in decision-making. Men were more likely to influence their own collaborative performance and their partners'. In the planning task, men were more likely to use their own judgement to influence their own collaborative outcome, and when it came to making decisions about social situations, men were more likely to

influence their own collaborative performance and their partners'. This was an unexpected finding, because women performed better on this task than men. This result, together with the interpersonal nature of the task that is traditionally seen as a more feminine domain, makes it surprising that men were more influential during collaboration on this decision-making task.

Another type of decision-making tasks are wisdom tasks. Young and old people perform the best on wisdom tasks when they can discuss the problem with somebody they know, when they have sufficient time for individually pondering the decision, or when they internally think about what a person they know would say to the problem (Staudinger & Baltes, 1996). This means that external and internal dyadic decision-making leads to higher quality wisdom decisions than individual decision-making. The usual focus on the individual when analyzing wisdom might lack ecological relevance, because wisdom can be considered as a prototype of an interactive-minds construct. Two important factors for optimal wisdom- related performance are the interaction with other peoples' minds and individual thinking to review other peoples' ideas (Staudinger & Baltes, 1996). The wisdom task showed significant age differences, i.e., old dyads profited more from the "external dialogue plus individual thinking time"- condition than young dyads.

Interdyadic differences in decision-making: Explanatory concepts. The findings reviewed show that men have more influence on collaborative outcome when the task is not very structured and allows more than one correct answer (Margrett and Marsiske, 2002). This finding clearly suggests that collaborative performance in decision-making tasks depends more on interpersonal and social factors than on individual cognitive abilities or task familiarity.

One important factor can be individual and dyadic beliefs and knowledge about how an optimal performance can be achieved. To examine this aspect of dyadic cognition, metacognitive questionnaires have been used in several studies on decision-making as well as other domains of dyadic cognition (Strough, Cheng, & Swenson, 2002). For example, Berg et al. (2003) found that couples report that when collaborating in everyday life, they often divide and delegate labour. Division of labour occurred because of special interests of couple's members, because of different abilities (Margrett & Marsiske, 2002), or based on a traditional distribution of responsibilities within the older couple that is not reported by younger couples (Berg et al., 2003). Some couples described collaboration as a form of problem solving, where one person takes the lead and the other person refines the plan. Most of the individuals said that their

partner's and their own problem solving styles were complementary (Berg et al., 2003), and that they were convinced that working together with a spouse leads to the best outcome in a dyadic cognition task (Feltmate, Gagnon, Kang, and Dixon, 2006), followed by collaborating with a friend, and working alone. That is despite the fact that typical for old adults is their general preference to solve everyday problems alone (Berg, Meegan, & Deviney, 1998; Blanchard Fields, Jahnke, Camp, 1995). Only old adults, who think that their own cognitive performance is weak, prefer to work with others (Strough et al., 2002). What is more, Margrett and Marsiske (2002) could demonstrate that people working with their spouse rated their expectations of satisfaction with collaborative teamwork more positively than the participants who were assigned to work with a stranger. In fact, self and partner-rated expectations of competitiveness were predictive of collaborative performance on tasks of planning, decision-making, and comprehension (Strough, Patrick, Swenson, Cheng, & Barnes, 2003).

One social factor shown to affect performance independent of the age of the dyads examined is the affiliation of the partners. The fact that there were more high-affiliation interactions on the decision-making task than on the planning task may be explained by the task being presented via computer, which led to more interaction between the couples in general (Berg et al., 2003). Another possible explanation is that vacation decisions are seen as very important, regularly occurring in everyday life, and, therefore, have to be discussed and negotiated intensively. This is different for the wisdom-related decision-making that may be optimized through the interaction with other minds of persons (external or in our own head) and individual thinking time to filter and review the different aspects. The age effects in favour of old dyads may depend on the familiarity with the problem domain and the existing knowledge interacting with good performance conditions providing an external dialogue and the time needed for an individual appraisal of the important aspects of the decision to be made.

Overall, the literature on dyadic decision-making in old age suggests a differentiation of paradigms to capture different decision-making domains of everyday relevance, and to integrate measures of dyadic interaction to analyze to which degree performance of process differences depend on the age, the sex, the cognitive abilities, or the task characteristics of the particular decision-making paradigm used.

2.1.6 Dyadic reasoning

Dyadic reasoning paradigms. Only two studies have looked at dyadic reasoning in old age. It is interesting to note that both studies analyze reasoning performance in old age and focus on the consequences of a reasoning-training program and the differences between individual and dyadic training on reasoning performance.

Margrett and Willis (2006) and Saczynski, Margrett and Willis (2004) used a letter series test (Blieszner et al., 1981, quoted in Margrett & Willis, 2006), a word series test (Schaie, 1985, quoted in Margrett & Willis, 2006) and a letter set test (Ekstrom et al., 1976, quoted in Margrett & Willis, 2006) to train and test reasoning abilities in older couples. The main difference between both studies is that Saczynski et al. (2004) included a post test three month after the training. In the study of Margrett and Willis (2006) the sample size was 49 older couples (M age= 71.43 years; M marriage= 46.53 years) and in the study by Saczynski et al. (2004) the sample size was 47 couples (M age= 71.6 years and M marriage= 47 years). Couples in both studies were randomly assigned to questionnaire only (n=31 individuals), individual training (n=32 individuals), and collaborative training (n=32 individuals). Within-subjects-designs have not been used in either of the studies. Possible influences like individual and dyadic training were manipulated and individual and dyadic measurements were possible in both studies. Both studies did not include measurements of relationship characteristics.

Dyadic reasoning paradigms: Performance or process differences. The two studies reviewed have analyzed inductive reasoning in older dyads. Both studies primarily focus on training this ability through a self-guided strategy training (individual and collaborative) and the question if dyadic training is better than individual training. The study by Saczynski et al. (2004) found that inductive reasoning training is related to gains in strategic behavior for individual and collaborative training groups on assessments completed alone and with the spouse. The performance level was maintained until three months after the end of the training program. There was no difference in strategy use at immediate post-test between the individual and the dyadic training group (see also Margrett & Willis, 2006). However, collaboratively trained people demonstrated a better maintenance of strategy use than individually trained people at the three months follow-up when assessed in a collaborative problem solving context. This means that collaborative learning alleviates dissipation of training effects observed once intervention is complete, but only in the collaborative context in which they were learned.

Interdyadic differences in reasoning: Explanatory concepts. A reason for the benefit of collaboratively trained people at the three months follow-up (Saczynski et al., 2004) could be that collaboratively trained dyads were more likely to apply their training to everyday life or engaged more in practice and reinforcement with their spouse than individually trained people. Margrett and Willis (2006) also mention the possibility that benefits of dyadic collaboration in their study could have become evident after more time had passed. It is also possible that the benefits of dyadic inductive reasoning training can be found in other aspects of the training such as the subjective experience, the transfer of training effects, or at other time points during the training. Clearly more research is needed to determine which factors may lead to improved dyadic reasoning skills in old adults, and more paradigms are needed to relate reasoning performance in laboratory tasks to reasoning in everyday tasks.

2.1.7 Dyadic comprehension

Dyadic comprehension paradigms. Just one study with a task to assess old dyads dyadic comprehension of everyday material exists. Margrett and Marsiske (2002) included a task in their study of old adults' everyday cognitive collaboration to assess old married couples ability to solve problems concerning everyday printed materials, e.g., health and medication use, financial management, or housekeeping. The sample size was 98 old married couples (M age = 72.90 years; M marriage = 45.81 years). Two parallel 14-item forms from the 28-item short form version of the everyday problems test (Willis & Marsiske, 1993; quoted in Margrett & Marsiske, 2002) were created. The questions were open-ended to provide enough possibilities for dyadic interaction. The task was unambiguous and highly structured, requiring one solution. Performance on the task was assessed by the total number of correctly answered items. The same task was done individually and in dyads, but because half the people worked with their spouse and the other half worked with a stranger, the study did not use a real within-subjects design. Manipulated possible influences were collaboration, gender, familiarity (actor –partner method), collaborative and task specific expectations and evaluations, and competitiveness. In order to find out about relationship characteristics that might influence collaboration, the authors used an open-ended interview about couples' daily collaboration.

Dyadic comprehension paradigms: Performance or process differences. Results indicate that men and women equally influenced each other on this task. Most important for collaborative

performance was the actor's performance in the work-alone condition, i.e., the better the performance when working alone, the better the collaborative performance. There was also a significant influence of the actor's partner, meaning that the better the actor's partner performed when alone, the better the actor's own performance in the collaborative condition.

Dyadic comprehension differences: Explanatory concepts. The authors explain this finding by saying that in highly structured tasks both partners are equally influential. However, it remains an open question how the dyadic interaction and the dyadic performance might change when task demands are increasingly more complex. Thus, more paradigms and more research are needed to better understand old dyads' comprehension performance.

2.1.8 Discussion

Clearly, dyadic cognition requires different abilities as well as different skills in dyadic ability management depending on the particular cognitive task examined. In addition, task requirements may interact differentially with relationship characteristics before and while working on the cognitive task at hand. Therefore, to summarize the results from studies on dyadic cognition in old age it is necessary to differentiate between dyadic memory, dyadic planning, dyadic decision making, dyadic reasoning, and dyadic comprehension. With respect to dyadic memory performance, empirical findings show that older adults' dyadic performance is superior to their individual memory performances. Compared to the pooled, non-redundant episodic memory performance of two individuals (nominal pairs), real dyads usually generate fewer correct recalls, but also make fewer mistakes (e.g. Ross et al., 2004). When the partners know each other (spouses, friends) and use a transactive memory system they are able to perform better then stranger dyads on memory tasks and sometimes even as well as nominal pairs (e.g., Johansson et al., 2000). It remains unclear if older dyads perform worse (Gould et al., 2002) or the same (Dixon & Gould, 1998) as younger dyads on memory tasks, although most studies show differences in interaction styles between young and old dyads. Results suggest that older adults communicate less efficiently, i.e., they tend to use more words, speak more slowly, and use fewer supportive words for their partners (Gould & Dixon, 1993; Gould et al., 1994; Gould et al., 2002).

For dyadic planning and dyadic decision making, Berg et al. (2003) did not find interaction differences between younger and older dyads. The hypothesis of the authors that

older adults would show more high-affiliation interactions than younger adults was not confirmed. High-affiliation interactions were associated with better planning and decision making in young and old couples though. On general planning and decision making performance measures old dyads performed as well as young dyads. It is interesting to note that contrary to the results on dyadic memory, older adults dyadic planning does not lead to more efficient plans than individual planning, probably because of the relatively low memory demands of the task. However, dyads make fewer planning errors than individuals (Cheng & Strough, 2004). If sex differences in planning exist, remains unclear, but Margrett and Marsiske (2002) found that in dyadic planning old men influence their own collaborative outcome more than women. A similar result was found for dyadic decision making: When it came to making decisions about social situations men aged 70 and older were more likely to use their own judgement to influence their own and their partners' collaborative outcome (Margrett & Marsiske, 2002). This finding is interesting, because old men and women performed equally well on the planning task and women performed better than men on the decision making task. On the everyday problems test (comprehension task), Margrett and Marsiske (2002) did not find such gender effects. Men and women were equally influential on this task. What was important for good dyadic performance on this task was the actor's performance in the individual condition and the actor's partner's performance in the individual condition.

With respect to dyadic decision making on wisdom tasks, young and old people perform better when they can collaborate with a familiar partner in a dyad than when they have to make decisions individually. For optimal decisions people need individual thinking time after the external or internal dyadic discussion (Staudinger & Baltes, 1996). Dyadic reasoning studies suggest that dyadic and individual inductive reasoning training is associated with better strategic behaviour on assessments completed alone or with the spouse. Interestingly, dyadic training leads to better strategy maintenance than individual training on the three months follow-up when assessed collaboratively. Finally, studies on dyadic comprehension suggest the importance of the individual performance for the collaborative performance.

We have started out by defining the requirements of optimal paradigms to examine dyadic cognition and its development in old age. According to these requirements, paradigms should be appropriate to use with individuals and dyads covering a wide age range, gender differences and hierarchy differences. Paradigms should also allow repeated measurement to be

used in age comparisons, comparisons between individual versus dyadic performance, longitudinal studies, and in married couples versus professional dyads of different ages. From an experimental point of view, paradigms should allow to manipulate the causal mechanisms suspected to influence dyadic performance.

Despite the relatively large number of studies on dyadic memory in old adults, it is not clear if the paradigms used do fulfil the criteria that would allow a wider use in empirical research or comparisons of results between studies. For example, with respect to the possible comparison between individual and dyadic performance, only Johansson et al. (2005) use a within-subjects design in their episodic and semantic memory tasks. Because of the use of repeated measurements, the study by Gould et al. (2002) allows comparisons between familiar and unfamiliar dyads (story recall, word recall, referential naming task). All other studies do not use within-subjects designs to compare performances of different groups. Comparisons between young and old couples have not been done with a within-subjects design in the studies reviewed. However, it appears that except for the referential naming task (Gould et al., 2002) all tasks examined may allow comparing individual and dyadic performance as well as interdyadic differences in performance. Thus, empirical testing is needed to demonstrate if the comparison between dyads is possible with all other paradigms.

The three studies on dyadic planning in old age have used tasks for which it stays unclear if they fulfil our criteria for experimental paradigms. A within-subjects design has partly been used by Margrett and Marsiske (2002), but the other studies do not use such a design. Causal mechanisms suspected to influence dyadic performance are age, gender, collaboration, but also relationship characteristics as well as collaborative expectations. Individual and dyadic measurements are potentially possible in all three planning tasks, but not done in Berg et al. (2003). Again, like with the dyadic memory tasks, there is not too much information on relationship characteristics. Berg et al. (2003) coded interactions into low and high affiliation interactions and Margrett and Marsiske (2002) asked about couples' daily collaboration. Thus, more empirical testing is needed to examine the influence of relationship characteristics on dyadic planning.

The inductive reasoning and the comprehension studies allow individual and dyadic measurements and therefore the manipulation of the suspected causal mechanism (dyadic vs. individual training). The authors examined old adults' learning abilities and, therefore, did not

include young dyads or same-sex dyads. A within-subjects design has not been used and relationship indicators have not been measured. Thus, more data are required to establish potential age effects and effects of dyadic collaboration in reasoning and comprehension tasks and to clarify the influence of relationship characteristics on the quality of reasoning and comprehension performance.

Overall, a number of paradigms have been or may be used to examine dyadic cognition in old age. Most paradigms may potentially be used to establish age and dyadic collaboration effects in dyadic cognition and to examine the role of particular explanatory mechanisms, but have not been used for this purpose. Therefore, more empirical research is needed to establish and understand the phenomena of dyadic cognition in old age, the potentials and adaptive capacities old dyads may possess and to improve our understanding in which types of tasks and in which dyadic constellations it is preferable to collaborate and which individual efforts are leading to better task performance. With respect to paradigm development, there seems to be a need for standard paradigms to be used for individual, dyadic and repeated individual and dyadic testing for each of the domains of cognition reviewed here. In addition, paradigms that clearly dissociate the required abilities would allow to better understand how dyads manage the abilities and responsibilities to optimize dyadic task performance. In the next chapter an empirical study using a problem solving task and a within-subject design with long-term married couples will address some of the questions mentioned above.

3 Study 2

3.1 When 2 is better than 1 + 1: Older spouses' individual and dyadic problem solving[2]

3.1.1 Introduction

In the next few years, an increasing number of couples will grow older and will have to solve emotional, physical, social, and cognitive problems in their everyday life. As a consequence, there has been a growing interest in older adults' collaborative cognition (e.g., Berg et al., 2007; Blanchard-Fields, 2008; Martin & Wight, 2008; Rauers, Riediger, Schmiedek, & Lindenberger, 2008). As already mentioned, collaborative cognition can be defined as two or more people working simultaneously on the same cognitive task towards a common goal (Dixon & Gould, 1996). In fact, everyday cognitive activities often take place with other individuals in a social context (Berg, Meegan, & Deviney, 1998; Blanchard-Fields, 2008; Hollingshead, 1998; Resnick, Levine, & Teasley, 1991). One may even assume that individual deficits in cognition may be overcome by collaboration and that especially older spouses who collaborate might have become collaboration experts in the course of their marriage (Andersson & Rönnberg, 1996; Dixon, 1999; Rauers et al., 2008). Whereas in novice dyadic collaborators the task management itself requires cognitive resources, expert collaborators might have established and practiced task management sufficiently well to be able to optimally match the available cognitive resources with the task requirements. Thus, older adults might be able to compensate for individual, age-related cognitive deficits through collaborative cognition (Dixon & Gould, 1996; Martin & Wight, 2008; Strough & Margrett, 2002).

There are several studies on collaborative recall in older adults which show that older adults can benefit from collaborating on memory tasks. In most cases, one individual trying to recall items, a story, or an intention performs worse than two people working jointly on the same task (Dixon & Gould, 1998; Johansson, Andersson, & Rönnberg, 2000; Johansson, Andersson, & Rönnberg, 2005; Ross, Spencer, Linardatos, Lam, & Perunovic, 2004). Finlay, Hitch, and Meudell (2000) argue that this is not surprising, because the model of statistical pooling of

[2] A similar version of this chapter is in press in the journal "European Psychologist" (Peter-Wight & Martin, in press)

abilities by Lorge and Solomon (1955) predicts this even in cases when no psychological processes influence the collaborative recall. For example, if one individual recalls five items (a, b, c, d, e) and the other individual also recalls five items (a, b, c, f, g), the dyad should recall a total of seven items (a, b, c, d, e, f, g; Finlay et al., 2000). However, when comparing older dyads' dyadic memory performance to this pooled, non-redundant performance of two individuals, i. e, the nominal group performance, real dyads typically perform worse than nominal dyads (Andersson & Rönnberg, 1995; Basden, Basden, Bryner, & Thomas, 1997; Johansson et al., 2000; Johansson et al., 2005; Ross et al., 2004).

Several studies with young dyads have shown that compared to individuals, dyadic interaction can enhance the quality of reasoning (Eysenck & Keane, 2000; Kuhn, Shaw, & Felton, 1997; all quoted in Métrailler, Reijnen, Kneser, & Opwis, 2008) and the performance on a scientific problem solving task (Okada & Simon, 1997; Teasley, 1995). However, so far it has not been investigated whether the results mentioned above also hold for collaborative problem solving in old age. Different from other forms of collaborative cognition such as memory, the best way to achieve a good problem solution requires the complementary sequencing of memory skills, e.g., to remember the rules of the task at hand and prior attempts to solve the problem, and reasoning, e.g., to combine the collected information and knowledge of the rules to produce an inference of a possible solution. More specifically, problem solving is defined as the process of taking corrective action in order to meet specified objectives. Problem solving is used to fill gaps in an action plan that has not yet become routine (Funke, 2003). In order to do that, one needs a mental representation of the path from the initial condition to the target state. This means that problem solving is about intentions (plans) and the gaps in these intentions that need to be filled by the process of problem solving. In problem solving, constructive as opposed to reproductive processes are necessary. Thus, the product in problem solving is an orchestrated sequence of memory and reasoning phases that could profit from practice in sequencing within a problem solving dyad. In addition, older individuals with reduced spatial memory and/or spatial reasoning skills might still be able to maintain a high level of problem solving performance through combining the individual strengths if the task and skill management itself is requiring few resources. In this study we used a problem solving task called "Black Box" (Krems & Johnson, 1995) in order to address the question whether older couples can profit from teamwork on such a problem solving task. The Black Box task is a well-defined problem solving task, i.e., there is an

optimal solution in terms of the steps required toward a successful solution. Usually, problem solving performance on well-defined tasks decreases with age (Berg, Strough, Calderone, Sansone, & Weir; Meacham & Emont, 1989; quoted in Thornton & Dumke, 2005), thus one could assume that by working together participants may compensate for individual deficits.

Despite the importance of examining the compensatory potentials of dyadic collaboration in well-defined problem-solving tasks in old age, very little is known about the potential complementary contributions of older individuals to dyadic problem-solving performance. Therefore, our study had four main goals. First, we analyzed if individual spatial memory and reasoning performance really predicts individual problem solving performance on the Black Box task (problem solving task requiring the sequential and complementary use of spatial memory and reasoning abilities; Krems & Johnson, 1995). Second, using a demanding problem solving task requiring the sequential orchestration of memory and reasoning, we hypothesized that old spousal dyads would perform better than old individuals despite additional collaboration costs. Third, to determine to which degree dyadic performance is depending on the actual collaboration, we compare actual dyadic performance to repeated individual performance and to the performance of nominal pairs. Fourth, to explore the possibility to relate performance in our laboratory dyadic problem solving task to everyday problem solving, we examined participants' reports of their collaboration on the problem solving task.

3.1.2 Methods

Participants

50 old married couples (N = 100 individuals) in the experimental group and N = 41 old individuals (21 women, 20 men) recruited for a repeated measures control condition volunteered to participate in the study. Spouses in the experimental group were between 57 and 81 years old, with a mean age of 67.32 (SD = 4.99). The age difference between spouses was no more than 10 years. On average, the couples had been married for 39.76 years to their current spouse (M = 39.76 years, range = 10-53, SD = 7.95). The average monthly household income (M = 6000-8000 SFr.) was relatively high, although there was substantial variation (SD = 1542 SFr., range = 4500-10'000 SFr. or more). Couples were highly satisfied with their marriage (M = 16.48 (maximum = 20), range = 10-20, SD = 2.29).

Participants in the control condition were recruited individually. 78% of them were married and 22% were single. The control group was between 60 and 76 years old (M = 65.95, SD = 3.79). The age difference between the control group and the experimental group was not significant (t = -1.578, df = 139, p = .08, two tailed). Their average monthly household income was similar to the experimental group (M = 6000-8000 SFr., SD = 1251, range = 2000-10'000 SFr. or more). The two groups did differ significantly in terms of their satisfaction with life (SWLS, Schumacher, 2003; M control group = 26.37, M experimental group = 29.16; t = 3.793, df = 139, p < .001, two tailed), even though both groups were relatively happy with their lives. No differences between groups were found in verbal intelligence (M control = 32.51, M experimental = 32.57; measured by the Mehrfachwahlwortschatztest-B, MWT-B; Lehrl, 1977).

All participants (couples and individuals) spoke German as their first language. Participants were recruited through newspaper advertisements, through presentations at the university for seniors in Zurich, through an existing list of older adults willing to participate in research studies and word of mouth. Participants were told that the study was about problem solving in the individual and the dyadic context. Study eligibility required furthermore that participants reported no diseases known to affect the central nervous system, and no colorblindness.

Problem solving task

We used a computerized problem solving task ("Black Box"). In this game task (Krems & Johnson, 1995) four atoms are hidden in the 9 X 9 matrix. Each atom has an invisible field of influence, where light rays are reflected in a 90° angle. Participants' goal was to determine the atoms' locations on the basis of light rays that were shot into the box/matrix and the knowledge of game rules how these light rays were or were not deflected by the atoms. Only the entrance and exit points of these light rays were visible; the paths of the light rays had to be imagined. Also, as mentioned before, entrance and exit points of the light rays had to be remembered, because they were only visible until a participant had indicated where an atom was hidden or had required another light ray. In most situations the requirement of one, two or even three more light rays was necessary and the entrance and exit points of all the light rays had to be memorized by participants in order to infer an atom's location. Two booklets with the description of the Black Box problem solving paradigm were used to introduce the Black Box task to both partners of a

couple at the same time. All subjects were thoroughly trained for 30 minutes on the rules of how light rays interacted with the atoms, and their fields of influence and reflection and deflection rules. Further detailed explanation of the Black Box paradigm is available in Figures 1a and 1b.

Procedure

The experiment took place in a laboratory in the psychology building of the University of Zurich. Each couple was briefed about the general purpose of the study and both spouses were asked to give written consent. All couples were assigned to work individually and afterwards together as a couple. The individual scores were used for individual scoring as well as for nominal dyadic pair scoring (see Andersson & Rönnberg, 1996). After the short introduction, both spouses were separated into two different rooms and each participant individually completed a demographic questionnaire that assessed the participant's age and if they were retired or not, years of education, monthly household income, marriage duration, health status, and their frequency of computer use. Afterwards, spouses individually filled out the "satisfaction with life scale" (SWLS, Schumacher, 2003) and the "relationship assessment scale" (RAS, Hendrick, 1988). Participants then read the instruction for the Black Box problem solving task, ran eleven pre-test games on the computer to become familiar with the task, and afterwards engaged individually in 9 scoring Black Box games (version A). After having finished their individual sessions, both spouses came together at the same computer and solved 9 Black Box games collaboratively (version B, parallel version of the Black Box problem solving task that was solved individually). The control group solved both versions of the Black Box task individually and in the same order as the experimental group. During the instruction and the pre-test phase participants had the opportunity to ask questions. During the 9 scoring games in the individual and the collaborative condition, the researcher was not in the room and no help was given. In the end, participants were administered a verbal intelligence test (measured by the Mehrfachwahlwortschatztest-B, MWT-B, a multiple-choice vocabulary test; Lehrl, 1977), a subtest extracted from the LPS 50+ that measured spatial reasoning (Sturm, Willmes & Horn, 1993), and a spatial short term memory test (Corsi blockspan of the Wechsler Memory Scale-Revised German version, WMS-R; Härtling et al., 2000). The split-half reliability coefficient of the spatial reasoning subtest is .93 and the retest reliability coefficient of the spatial short term memory test is .60.

All procedures were completed in one session that lasted about two hours. In the end, participants were debriefed and thanked for participation.

3.1.3 Results

Design

We used a 2×2 ANOVA design to compare spouses' dyadic performance to their individual performance and to the repeated individual performance of the control group. The first factor (within-participants variable) referred to version A and version B of the problem solving task; the second factor (between-participants variable) referred to type of group (experimental group versus control group). The dependent variable was the number of atoms found in version A and version B, respectively. The individual results from both partners of a couple were then pooled to create the nominal score (predicted potential) for the dyad and with a paired *t*-test we analyzed the difference between the nominal pair scores and the actual couple scores. For the comparison between nominal pairs and actual couples, the dependent variable was the number of correctly solved games (a game is correctly solved when all four atoms have been found).

Statistical analyses

In a first step we analyzed with N = 131 older individuals (experimental and control group; the difference to sample size of 141 is due to non-completion of reasoning and memory test in 10 individuals), if individual spatial memory and reasoning performance would predict, as we hypothesized, individual problem solving performance on the Black Box task. We also looked if age was an important predictor for performance on the Black Box task. Therefore, we conducted a multiple regression analysis with these predictors. Using the enter method with age, spatial memory, and reasoning as predictors and individual Black Box performance as the dependent variable, a significant model emerged: F (3, 127) = 17.713, $p < .001$. This model explains 29.5% of the variance (Adjusted $R^2 = .278$). Table 4 gives information for the predictor variables entered into the model. All three predictors were significant. Table 5 shows the correlation matrix for the predictor variables.

Table 4: Unstandardized and standardized regression coefficients as well as collinearity statistics for the variables entered into the model (N = 131)

Variable	*B*	*SE B*	ß	*Tolerance*	*VIF*
Age	-.18	.09	-.15*	.98	1.02
Spatial reasoning	.29	.08	.28**	.84	1.19
Spatial short term memory	.58	.14	.33**	.85	1.18

Note. B = unstandardized coefficient; *SE B* = standard error of *B;* β = standardized coefficient; *VIF* = variance inflation factor.
*$p < .05$. **$p < .01$.

Table 5: Correlation matrix for the predictors included in the multiple regression analysis (N = 131)

Predictors	1	2	3
1. Age	-	-.16	-.13
2. Spatial reasoning		-	.39
3. Spatial short term memory			-

In a second step we wanted to know if old spousal dyads would profit from collaboration on the problem solving task and perform better in the dyadic situation than in the individual situation (spouses were working alone). We also compared the dyadic performance to repeated individual performance of the control group to show that superior dyadic performance was caused by actual collaboration and not by a potential training effect. The 2(version A vs. version B) × 2(experimental group vs. control group)-ANOVA revealed a significant main effect for repetition (version A vs. version B; F (1, 89) = 48.95, $p < .001$, partial $\eta^2 = .355$), suggesting better performance in version B over the two groups. The main effect of group classification was not significant (F (1, 89) = 1.27, $p = .263$, partial $\eta^2 = .014$), which shows that there were no performance differences between the control group and the experimental group. The interaction effect for type of version by type of group was significant (F (1, 89) = 24.37, $p < .001$, partial $\eta^2 = .215$). The *t*-test revealed that couples did profit significantly from the dyadic situation (version B) compared to the individual situation (version A; $t = 8.105$, df = 49, $p < .001$, one tailed). There was no performance difference in the two versions for the control group ($t = 1.602$, df =

40, p = .117, one tailed). This effect suggests that, according to our hypothesis, older spouses improved their performance significantly in the dyadic situation compared to the individual situation and profit significantly more from repeated problem solving than the control group.

In a third step we conducted a paired *t*-test in order to compare nominal pair performance (pooled ratings of 100 individuals/spouses of experimental group) to the actual dyadic performance of the experimental group). The mean difference between "nominal pairs" and "actual couples" was .76 and the 95% confidence interval for the estimated population mean difference is between 1.288 and .232. The effect size was only small (d = 0.336). The paired *t*-test showed that the difference between conditions was significant (t = 2.893, df = 49, p < .01, one tailed), i.e. couples performed significantly better than nominal pairs. Table 6 shows the means, standard deviations, and the sample size of this analysis.

Table 6: Number of correctly solved games for couples, nominal pairs and individuals from the experimental group

Experimental group	Mean	Standard deviation	Sample size
Couples	4.20	2.54	50
Nominal pairs	3.44	1.98	50
Individuals	2.31	1.78	100

In a fourth step we were interested in the everyday relevance of collaboration on the Black Box problem solving task, e.g. we wanted to explore the possibility to relate performance in our laboratory dyadic problem solving task to everyday problem solving. Therefore, we asked spouses individually if they found Black Box-collaboration reflective of their everyday collaboration. 24% of the participants found the collaboration on the Black Box task very typical for their collaboration in daily life, 43% of the participants responded that collaboration on the Black Box task was typical, 21% found the collaboration rather typical, and only 12% did not think the collaboration was reflective of their everyday collaboration.

3.1.4 Discussion

Our study was designed to examine whether older couples profit from the dyadic situation on a computer-based problem solving task that can be optimally solved when dyads

manage to distribute responsibilities between the memory demands and the reasoning demands of the task. The results extend the existing knowledge on dyadic cognition in old adults in three important ways. First, we managed to devise a new paradigm to examine individual and dyadic problem solving, i.e., a task that requires the complementary sequencing of memory and reasoning. In fact, the multiple regression analysis demonstrated that Black Box performance was predicted by spatial reasoning and spatial short term memory. Thus, the paradigm makes demands on two distinct cognitive abilities that, based on the high complexity of overall task demands, optimally will be contributed by two individuals combining their efforts in each respective ability to achieve the best possible task performance. As a consequence, our task, different from most dyadic cognition paradigms, should be useful to study complementary dyadic problem solving in old age. Couples in this study said that their collaboration on the Black Box task matched their collaboration in everyday life. However, if one can really compare dyadic problem solving on the Black Box task and in everyday situations still needs to be tested, by, for example, comparing spouses' interactions on the laboratory task and in everyday life.

Second, our analyses show that elderly couples performed better on the problem solving task in the dyadic situation than when they worked individually. This result replicates findings from other studies on collaborative memory in which older dyads typically outperform one solitary individual in absolute terms (Johansson et al., 2000). However, contrary to most findings on collaborative memory, the comparison between the actual dyadic performance and the nominal pair performance on the problem solving task revealed, as hypothesized, a significantly better performance of real couples, i.e., in this situation one may say that 2 is better than 1 + 1. Unlike on memory tasks in which the interaction between the members of a dyad may inhibit optimal performance, on a problem solving tasks it seems as if collaboration costs are smaller than collaboration gains. One interpretation of this difference to other collaborative cognition studies is the task itself. Whereas in most tasks used so far both partners received identical materials and tasks requiring identical abilities to perform well, the problem solving task we used required the complementary sequencing of memory and reasoning skills. A complex task like this might suggest to participants that sharing the task (one person does the memory part and the other person does the reasoning) according to each partners' specific abilities would be an advantage. In fact, 78 % of the couples said that they had somehow worked together in the dyadic situation. Superior dyadic compared to individual problem solving performance could

also be a result of the long marriage duration of the elderly couples. Maybe if the sequencing in a task is of high importance, dyads with a long history of everyday dyadic problem solving can profit from this experience and reach optimal performance. This explanation is supported by the result that most couples reported their collaboration on the Black Box task to be reflective of their everyday collaboration, which means that most couples have practiced collaboration often and therefore might be collaboration experts. Further empirical testing with two different age groups and two different tasks is necessary to definitely answer the question if the higher performance of couples is specific to older couples or to the type of task used.

Third, the Black Box paradigm has a great potential to answer further questions in the field of dyadic cognition. Although most old couples did obviously manage to distribute the efforts between them rather efficiently, the task itself provided little guidance as to how roles between partners are distributed. If in fact the efficient distribution and the management of individual efforts explains the better performance of real pairs, then variations in dyads examined, instructions, and pre-training should further increase the advantage of collaboration in the paradigm. For instance, one may compare average dyads performance in which both partners have both abilities to dyads in which one partner has only one of the two abilities required, thus making collaboration necessary to solve the task. This could be achieved by virtual partners, a trained experimenter, or by using dyads in which one partner is suffering from memory loss or inability to reason. It would also be possible to construct parallel versions of the task that allow to examine interactions between task and gender; in the current version of the task, most often men took the lead in dealing with the computer even when it might have been more efficient for the women to take the lead. Adapted within a longitudinal design it would even be possible to examine to which degree dyads are flexible in the management of solving the task. Furthermore, by making obvious to the spouses which partner has which skills, dyadic collaboration might also be improved. Usually, both spouses will have some skills in reasoning and some memory skills, but with an intensive reasoning pre-training for the one partner and memory pre-training for the other partner, effects of complementarity could be tested more strictly. In the context of elderly spouses it would also be possible to change the saliency of the abilities needed to solve the task optimally and analyze if couples, when they know about the abilities the task requires, are able to improve their performance even more. This could easily be done with a slightly adapted instruction including the description of abilities needed to solve the task. Finally, one

may examine the effects of task management training, thus allowing to determine if even with lower levels of individual skills of memory and reasoning, task performance may be improved by better management of the available cognitive resources. Hence, our paradigm is recommended for use in future research disentangling the role of individual abilities and their dyadic management in working on higher-order cognitive tasks. This would also provide the basis to develop an assessment tool for measuring dyadic aptitude and to relate performance in the different versions of the paradigm to everyday performance.

4 Study 3

4.1 Interindividual vs. interdyadic associations between dyadic coping and relationship satisfaction in older adults' long-term marriages[3]

4.1.1 Introduction

Interindividual differences in dyadic coping have been found to be important predictors of marital satisfaction in younger and middle-aged couples. In addition, dyadic coping seems to be an even more important predictor for marital satisfaction than individual coping or social support from persons outside of the relationship (Gmelch & Bodenmann, 2007). Dyadic coping is related to relationship quality by two mechanisms (Bodenmann, 2005): On the one hand, dyadic coping reduces the negative influence of stress on the relationship. In this case, dyadic coping has a moderating effect. On the other hand, through dyadic coping efforts partners perceive their relationship as supportive, which leads to more mutual trust, intimacy, and solidarity between partners. In fact, in a meta-analysis Bodenmann (2000) finds correlations from $r = .32$ ($p < .05$) to $r = .63$ ($p < .001$) between the total dyadic coping score and the total relationship satisfaction score of young and middle aged couples ($g = 1.21$). On a subscale level, the highest correlations were found between supportive dyadic coping (e.g., "she gives me the feeling that she understands me and my problems") and common dyadic coping (e.g., "if something bothers both of us, we usually try to solve the problem together and look for a solution together") respectively, and relationship satisfaction (correlations up to $r = .62$). However, most of these studies have only included samples of young or middle aged married individuals and have related interindividual differences in dyadic coping within the group of husbands versus wives.

Interdyadic coping differences as well as older spousal dyads' coping and relationship satisfaction have received little attention (Bodenmann, 2000; Levenson, Carstensen, & Gottman, 1993; Schmitt, Kliegel, & Shapiro, 2007). However, these two points are highly important. First,

[3] A similar version of this chapter is currently being prepared for publication (Peter-Wight, Martin, Schmitt, & Bodenmann, in prep.)

if one has a sample of married individuals and wants to learn about spousal dyads, it makes sense to use the couple as the unit of the analysis. From an interindividual difference perspective, a strong relation between dyadic coping and relationship quality suggests that in all (married) individuals better dyadic coping contributes to higher relationship quality. However, it is plausible to assume that this effect depends on the dyadic coping responses of one's spousal partner. That is, the positive effect of better individual coping may be larger in spousal dyads including a partner with low dyadic coping (compensation hypothesis) or with also high dyadic coping (accumulation hypothesis). In any case, the predictors of actual dyads relationship quality must not be identical to individual dyads members' relationship quality except when both partners completely agree in self-and other ratings of dyadic coping. Thus, an analysis of actual dyads' dyadic coping and relationship quality is an important complement to the interindividual perspective.

Second, given the findings that marital satisfaction influences mental and physical health (Diener et al., 2000; Tucker, Friedman, Wingard, & Schwartz, 1996), a high marital satisfaction level may become particularly important for long-term marriages of older adults, who are at higher risk for these health problems. In addition, especially for older adults the importance of the partner as a source of social support might be very important for several reasons. First, retirement, relocation, and death of friends and family can lead to a narrowing of social networks, which again can increase the importance of the partner as a source of social support. Second, health problems of older adults might also limit access to other social support systems (Gagnon, Hersen, Kabacoff, & Van Hasselt, 1999). Third, after a long time of leading a professional life and raising children, there is a stronger focus on the couple relationship again (Kruse, 1992). Forth, because emotion regulation is of high importance to older people, they might prefer to spend time with well-known social partners such as one's husband or wife (with them emotions are predictable and more positive; Carstensen, 1992).

In one of the few studies on predictors of marital satisfaction of older married individuals, Kaslow and Robison (1996) analyzed factors that led to long-term happy marriages (couples were married between 25 and 46 years). Individuals from happy couples showed positive communication strategies and perceived their partners as good listeners. Supportive behaviors and positive interactions were perceived as highly important factors for long-term, satisfying relationships. Levenson, Carstensen, and Gottman (1993) demonstrated that compared to

individuals from middle-aged marriages, individuals from older couples showed a reduced potential for conflict and more sources of pleasure. The association between conflicts and relationship satisfaction was stronger than the relation between sources of pleasure and relationship satisfaction. Schmitt, Kliegel, and Shapiro (2007) showed with data from 588 married individuals in middle and old age that a high perceived quality of dyadic interaction was the strongest predictor for marital satisfaction (particularly for women). Socio-economic factors and personality played a minor role in predicting marital satisfaction. In a study with three age groups (young, middle aged, old), Bodenmann (1998) found significant correlations between dyadic coping and relationship satisfaction for all age groups. Based on Kessler's (1991) findings that the relation between perceived support and adjustment to stress is stronger than the relation between actual support and adjustment to stress, Acitelli and Antonucci (1994) argue that received support (i.e., actual support by the partner) is less important for relationship satisfaction than perceived social support. Perceived reciprocity (Acitelli & Antonucci; 1994) or the equity-index (Gmelch & Bodenmann, 2007), i.e., one partner's view that a given support is reciprocated in kind, have also been shown to be relevant for relationship satisfaction of young (Gmelch & Bodenmann, 2007) and older individuals (especially for wives' relationship satisfaction, see Acitelli & Antonucci, 1994). Overall, older couples may be experts in dyadic coping and the relation between dyadic coping and relationship quality is potentially stronger than in younger age groups. The combined analysis of interindividual and interdyadic differences allows an in-depth examination of the relation between dyadic coping and relationship quality in older couples in long-term marriages.

Our study had two main goals. First, on the basis of studies by Bodenmann (2000; Bodenmann & Cina, 1999; Bodenmann & Widmer, 2000) and Bradbury, Fincham, and Beach (2000) we aimed at demonstrating that interindividual differences in older husbands' and wives' dyadic coping strategies are significantly associated with interindividual differences in marital satisfaction. If relationship quality plays a larger role for older married couples, the relation should be stronger as has been reported for young and middle-aged couples. We also hypothesized that husbands' and wives' perception of the partner's dyadic coping is more important for their relationship satisfaction than partner's actual coping (cf. Kessler, 1991). Second, we hypothesized that an analysis of the interdyadic association between coping and relationship satisfaction will show different results as on the individual level. In particular, we

assumed that more variance in relationship quality can be explained on the interdyadic level because it does not require to assume that both members of the marital dyad experience and use dyadic coping equally, but complementary. Therefore, we also hypothesized that the overlap between couples' self-reported dyadic coping and self-reported perception of partner's dyadic coping (perceived reciprocity; Acitelli & Antonucci, 1994; equity index; Gmelch & Bodenmann, 2007) is associated with marital satisfaction in long-term marriages.

4.1.2 Methods

Participants

The sample for this study consisted of 138 married couples (N = 276 individuals). Their ages ranged from 60 – 84 years with an average age of 68.3 years (*SD* = 5.6 years). On average, the couples had been married to their current spouse for 42 years (range = 25-57, *SD* = 6.2). 93.5% were retired and 96% answered to be able to handle financial emergencies (1.8% were not prepared, 2.2% did not answer). All participants spoke German as their first language and were in good health (SF-36, Kirchberger, 2000; on all eight subscales our sample scored higher than the age related normative sample). Questionnaires were sent to couples homes and couples were asked to answer them individually and return them.

Measures

The dyadic coping questionnaire (FDCT-N, Bodenmann, 1996) is a questionnaire that measures dyadic coping in intimate relationships. It consists of 41 items that can be answered from 1 (= never) to 5 (= very often). There are two versions of the questionnaire - one for women and one for men. Both partners answer the questionnaire individually. The questionnaire consists of the following scales: Own stress communication (emotion-centered, problem-centered), own supportive dyadic coping (emotion-centered, problem-centered, delegated), own negative dyadic coping (hostile, ambivalent, withdrawal), own evaluation of dyadic coping (satisfaction with dyadic coping, efficiency of dyadic coping), partner's stress communication (emotion-centered, problem-centered), partner's supportive dyadic coping (emotion-centered, problem-centered, delegated), partner's negative dyadic coping (hostile, ambivalent, withdrawal), common dyadic coping (emotion-centered, problem-centered), and avoidance of dyadic coping.

Scores for the scales mentioned above as well as scores for positive dyadic coping (20 items; 20-100 points), negative dyadic coping (10 Items; 10 – 50 points) and stress communication (8 Items; 8 – 40 points) can be calculated. By summarizing the scores for positive dyadic coping, stress communication und negative dyadic coping (reversed polarity), the range for the total score for dyadic coping for the 30 items is from 38 to 190 points. Cronbach' Alpha is $\alpha = 0.89$ for positive dyadic coping, $\alpha = 0.68$ for negative dyadic coping, $\alpha = 0.80$ for stress communication, and $\alpha = 0.92$ for the total score. Retest-reliability for the different scales is between $rtt = 0.63$ and 0.83.

The relationship satisfaction questionnaire (PFB; Hahlweg, 1996) is a standardized instrument for the differential evaluation of relationship satisfaction. It has been used in therapy as well as in research contexts. Relationship quality is measured on a four-point scale (0 = never/very rarely, 1 = rarely, 2 = often; 3 = very often). The questionnaire consists of 31 items, one of which asks about global marital happiness (0-5, six-point scale). A total score and scores for the three subscales "quarreling" (*M* satisfied marriages = 5, *M* unsatisfied marriages = 13), "togetherness/communication" (*M* satisfied marriages = 20, *M* unsatisfied marriages = 13), and "tenderness" (*M* satisfied marriages = 20, *M* unsatisfied marriages = 13) can be built. A total score of 54 or more indicates a satisfying relationship, whereas lower scores indicate an unhappy relationship.

4.1.3 Results

Statistical analysis

In the first part of this section, the basic descriptors of the relationship satisfaction and dyadic coping are reported. Next, we examine correlations between dyadic coping and relationship satisfaction and if wives' and husbands' perception of partner's coping is a better predictor for relationship satisfaction than partner's actual coping. Then, on the dyadic level, we examine if older couples' dyadic coping strategies are significantly related to their marital satisfaction and to which degree the overlap between couples' self-reported supportive dyadic coping and couples' self-reported perception of partner's supportive coping (i.e., perceived reciprocity; Acitelli & Antonucci, 1994) predicts marital satisfaction in long-term marriages.

On average, older spouses reported a high level of marital satisfaction ($M = 56.85$, $SD = 12.79$; values ≤ 53 suggest a rather unhappy marriage). However, individuals from happy

couples from the norm sample (younger, 41-50 years) showed a mean satisfaction level of 65 (*SD* = 11), a significantly higher score (*t* = -8.38, df = 137, *p* = 0.000). On the subscale "tenderness" older spouses show similar scores (*M* = 15.2, *SD* = 6) as individuals from unhappy couples (i.e., in marital therapy) from the norm sample (*M* = 13, *SD* = 7 for individuals from unhappy couples, *M* = 20, *SD* = 5 for individuals from happy couples). However, the difference in the subscale tenderness between older couples and the unhappy couples from the norm sample is still significant (*t* = 6.10, df = 137, *p* = 0.000). Significant differences between older couples and happy couples of the norm sample were also found on the other two subscales, “quarreling” and “togetherness/communication” (*t* = 5.08, df = 137, *p* = 0.000; *t* = -5.49, df = 137, *p* = 0.000), but on these to scales older couples’ scores (“quarreling”: *M* = 6.56, *SD* = 5.10, “togetherness/communication”: *M* = 18.23, *SD* = 5.37) were comparable to the ones of happy couples (“quarreling”: *M* = 5, *SD* = 5; “togetherness/communication”: *M* = 20, *SD* = 5). There is no significant difference between older wives’ (*M* = 57.35; *SD* = 12.57) and husbands’ (*M* = 56.35; *SD* = 13.04) global relationship satisfaction score (*t* = -1.02, df = 137, *p* = 0.309), their “quarreling”-score (*t* = 0.73, df = 137, *p* = 0.470), and their “togetherness/communication”-score (*t* = -1.921, df = 137, *p* = 0.057). Wives’ scores on “quarreling” and “togetherness/communication” were a little higher than husbands’ scores (for wives: *M* = 6.72, *SD* = 5.23; for husbands: *M* = 6.40, *SD* = 4.98). Significant differences between husbands and wives were found on the subscale “tenderness” (*t* = 4.60, df = 137, *p* = 0.000). Wives had significantly higher scores (for wives: *M* = 16.26, *SD* = 5.85; for husbands: *M* = 14.10, *SD* = 5.86). The average difference is *M* = 3.34 (*SD* = 11.10) and the range of difference for relationship satisfaction within dyads is 0 to 38. This rather large range suggests that differences between individuals within the same dyad can be substantial and an intradyadic perspective complementing the interindividual analysis is warranted.

Older spouses mean score for total dyadic coping (sum of positive dyadic coping, stress-communication, and negative dyadic coping (reversed polarity) was M = 140.43 (SD = 17.44; possible range = 38-190). Means, standard deviations, ranges, and possible ranges for positive dyadic coping (consists of the two scales supportive dyadic coping and mutual dyadic coping), negative dyadic coping, and stress communication are shown in Table 7.

Table 7: Scores for positive dyadic coping, negative dyadic coping, and stress communication (N = 276)

	Mean	Std. Deviation	Range	Possible range	N
Positive dc	72.55	11.02	39-98	20-100	276
Negative dc	18.09	5.69	10-44	10-50	276
Stress communication	25.92	5.02	15-40	8-40	276

Paired t-tests on the subscale level showed that older women had significantly higher scores (M = 13.52, SD = 2.75) than older men (M = 12.38, SD = 3.08) in own stress communication (t = 3.65, df = 137, $p < 0.001$, d = 0.47) and, respectively, men reported higher partners' stress communication (M = 13.56, SD = 3.01) than women (M = 12.33, SD = 3.08, t = -3.50, df = 137, $p < 0.001$, d = 0.41). Older wives reported significantly more negative dyadic coping of their partners (M = 6, SD = 2.33) than older husbands (M = 5.08, SD = 1.81, t = 4.89, df = 137, $p < 0.001$, d = 0.48). No gender differences were found in common dyadic coping, own and partner's supportive dyadic coping, and own negative dyadic coping.

In a second step, we analyzed if older husbands' and wives' dyadic coping correlates with their relationship satisfaction. Therefore, on the interindividual level, we correlated self-rated dyadic coping scores of husbands and wives (own and partner's stress communication, own and partner's supportive dyadic coping, own and partner's negative dyadic coping, common dyadic coping) with their total relationship satisfaction score. Results are shown in Table 8.

Table 8: Correlations (r) between dyadic coping and relationship satisfaction for husbands and wives (N = 138)

	PFB	
Dyadic coping	Wives	Husbands
own stress communication	.34***	.41***
partners' stress communication	.34***	.39***
own supportive dc	.46***	.29***
partners' supportive dc	.67***	.64***
own negative dc	-.46***	-.36***
partners' negative dc	-.66***	.-39***
mutual dc	.60***	.59***

*** $p \leq 0.000$, one tailed.

In a multiple regression analysis, wives' dyadic coping explained 58% of their relationship satisfaction (F = (7, 130) = 28.03, $p < 0.001$). Husbands' dyadic coping explained 55% of their relationship satisfaction (F = (7, 130) = 25.13, $p < 0.001$). Partner's supportive dyadic coping was, as expected, a significant predictor for husbands' and wives' relationship satisfaction. Table 9 and Table 10 inform in more detail about the predictor variables entered into the models.

Table 9: Unstandardized and standardized regression coefficients for wives dyadic coping predicting wives relationship satisfaction

Variable	*B*	*SE B*	β
own stress communication	.13	.33	.03
partners' stress communication	.15	.27	0.04
own supportive dc	2.25	1.65	0.10
partners' supportive dc	3.44	1.70	0.20*
own negative dc	-0.33	0.34	-0.07
partners' negative dc	-1.90	0.50	-0.35***
mutual dc	0.68	0.24	0.22**

Note. *B* = unstandardized coefficient; *SE B* = standard error of *B*; β = standardized coefficient.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 10: Unstandardized and standardized regression coefficients for husbands' dyadic coping predicting husbands' relationship satisfaction

Variable	*B*	*SE B*	β
own stress communication	-0.09	0.32	-0.21
partners' stress communication	0.69	0.32	0.16*
own supportive dc	-6.14	1.90	-0.26**
partners' supportive dc	7.45	1.44	0.43***
own negative dc	-0.54	0.34	-0.12
partners' negative dc	-1.19	0.54	-0.17*
mutual dc	1.15	0.28	0.36***

Note. *B* = unstandardized coefficient; *SE B* = standard error of *B*; β = standardized coefficient.
*p = 0.050. **p < 0.01. ***p < 0.001.

Dyadic coping strategies reported by partners (actual dyadic coping of the partner) were less important for one's own relationship satisfaction. A multiple regression analysis showed that husbands' reported dyadic coping explained 24.3% of wives relationship satisfaction (F = (7, 130) = 7.28, p < 0.001). Wives dyadic coping explained 24.5% of husbands' relationship satisfaction (F = (7, 130) = 7.34, p < 0.001). Table 11 and Table 12 give information about the predictor variables entered into the model.

Table 11: Unstandardized and standardized regression coefficients for husbands' dyadic coping predicting wives relationship satisfaction

Variable	*B*	*SE B*	β
own stress communication	.737	.403	.181*
partners' stress communication	-.112	.403	-.027
own supportive dc	2.033	2.377	.089
partners' supportive dc	2.502	1.807	0.150
own negative dc	-.822	.419	-.189
partners' negative dc	-1.078	.678	-.156
mutual dc	.198	.346	.064

Note. *B* = unstandardized coefficient; *SE B* = standard error of *B*; β = standardized coefficient.
*p = 0.050.

Table 12: Unstandardized and standardized regression coefficients for wives' dyadic coping predicting husbands' relationship satisfaction

Variable	*B*	*SE B*	β
own stress communication	.707	.453	.149
partners' stress communication	.025	.376	.006
own supportive dc	5.930	2.301	.258*
partners' supportive dc	-1.668	2.364	-.095
own negative dc	-.057	.469	-.012
partners' negative dc	-1.969	.699	-.352**
mutual dc	.236	.327	.074

Note. *B* = unstandardized coefficient; *SE B* = standard error of *B*; β = standardized coefficient.
*$p = 0.050$. **$p < 0.01$.

Regression analyses were repeated on the interdyadic level in order to get more information on the actual couples. Couples dyadic coping explained 64.6% of the total couple relationship satisfaction (sum of PFB husband and PFB Wife; $F = (7, 130) = 36.65$, $p < 0.001$). Significant predictors were partner's supportive dyadic coping (sum of husbands and wives scores; $B = 7.86$, $SE\ B = 1.81$, $\beta = 0.415$, $p = 0.000$), common dyadic coping ($B = 0.86$, $SE\ B = 0.27$, $\beta = 0.26$, $p = 0.002$) and partners' negative dyadic coping ($B = -1.64$, $SE\ B = 0.52$, $\beta = -0.253$, $p = 0.002$). Own and partners' stress communication ($B = 0.26$, $SE\ B = 0.38$, $\beta = 0.052$, $p = 0.487$; $B = 0.38$, $SE\ B = 0.37$, $\beta = 0.074$, $p = 0.312$), own negative dyadic coping ($B = -0.44$, $SE\ B = 0.34$, $\beta = -0.094$, $p = 0.203$), and own supportive dyadic coping ($B = -3.17$, $SE\ B = 1.99$, $\beta = -0.130$, $p = 0.113$) had no significant influence. Correlations for the predictor variables are shown in Table 13.

Table 13: Correlation matrix for the predictors included in the multiple regression analysis (N = 138)

Predictors	1	2	3	4	5	6	7
1. own stress communication	-	.64**	.36**	.59**	-.17	-.19*	.48**
2. partners' stress communication	-	-	.53**	.54**	-.17*	-22*	.51**
3. own supportive dc	-	-	-	.70**	-.23**	-.26**	.68**
4. partners' supportive dc	-	-	-	-	-.36**	-.48**	.71**
5. own negative dc	-	-	-	-	-	.72**	-.28**
6. partners' negative dc	-	-	-	-	-	-	-.36**
7. mutual dc							-

*p = 0.050. **p < 0.01, two tailed.

Our forth hypothesis concerning the importance of an overlap between self-reported supportive dyadic coping and self reported perception of partner's supportive dyadic coping (e.g., perceived reciprocity) for marital satisfaction was also confirmed by the data. There were significant negative correlations (the smaller the difference between the two coping perceptions, the higher the relationship satisfaction) between couples overlap of supportive dyadic coping and couples' relationship satisfaction (r = -.47, N = 138, p = 0.000, one-tailed). Overlap in stress communication was also correlated with marital satisfaction (r = -.28, N = 138, p = 0.000, one-tailed).

4.1.4 Discussion

In the literature on dyadic coping, a strong association between interindividual differences in dyadic coping and relationship satisfaction of younger and middle aged couples has been shown, but the predictive power of dyadic coping for older adults' relationship satisfaction (Bodenmann & Widmer, 2000) have received relatively little attention so far. Therefore, our study had two main goals. First, on the interindividual level, we examined the association between older wives and husbands' dyadic coping and relationship satisfaction and if the individual perception of partners' dyadic coping was more important for individual relationship satisfaction than partner's actual dyadic coping. Second, we hypothesized that an analysis of the association between coping and relationship satisfaction on the couple level

shows different results as on the individual level and that interdyadic differences in perceived reciprocity in dyadic coping were associated with marital satisfaction in long-term marriages.

The descriptive results show that older husbands and wives were quite satisfied with their marriage, i.e., their average marital satisfaction level was above the critical cut-off of 53. However, compared to the norm sample (aged 41-50; Hinz, Stöbel-Richter, & Brähler, 2001), older individuals in this study were significantly less happy with their marriage, which means that our results support the findings reported by Van Laningham et al. (2001), showing a decrease of relationship satisfaction over the lifespan. Another reason for our finding could be the questionnaire we used (PFB, Hahlweg, 1996). Even though the PFB has been widely used in research on couples and is comparable to other relationship satisfaction questionnaires, it might not be the optimal questionnaire to capture older adults' relationship satisfaction, especially because of the subscale "tenderness" on which couples in this study scored almost as low as the normative sample that was in couples' therapy. This result for the subscale "tenderness" is in line with findings by Klaiberg, Brähler, & Schumacher (2001) showing older couples' global marital satisfaction level to be higher than their satisfaction with sexuality and with several studies that have shown a decrease in sexuality over the lifespan (Klaiberg et al., 2001; Mares & Fitzpatrick, 1996). Next to age, possible reasons for this decrease are biological factors (health), social aspects (availability of partner), individual characteristics (education, sexual experience), social norms and cohort effects. Also, Schmitt and Re (2004) pointed out that a difference must be made between sexual interest (stable over the lifespan) and sexual activity (decreases over the lifespan) and also between satisfaction with sexuality and sexual activity (Klaiberg et al., 2001). Fooken (2005) reports, that particularly satisfaction with sexuality predicts relationship satisfaction. However, the question about the development of relationship satisfaction over the lifespan cannot be answered in this study. In order to capture relationship development, longitudinal studies analyzing the interaction between age, marriage duration and cohorts are needed.

Our results concerning gender differences support findings reported by Riehl-Emde & Willi (1999; see also Glenn, 1975), who also did not find gender differences in global marital satisfaction levels. Consistent with Bodenmann and Widmer's (2000) results on gender differences in dyadic coping in younger and older adults, we found more stress communication in older women than in older men. Wives in our study also reported significantly more negative

dyadic coping of the partner than their husbands. Contrary to the findings by Depner and Ingersoll-Dayton (1985), where older women provided more conjugal support than their husbands and received less social support from their spouses, we did not find gender differences in supportive dyadic coping.

As we predicted on the basis of results found with younger and middle aged couples, interindividual differences in older wives and husbands' dyadic coping explained a substantial part of their interindividual relationship satisfaction. Interestingly, for wives and husbands relationship satisfaction different predictors emerged. The most important predictor for wives' relationship satisfaction is the partners' negative dyadic coping. The more negative dyadic coping wives report of their partners, the unhappier they are with their marriage. Also important predictors were common dyadic coping and partner's supportive dyadic coping, which again were the two most important predictors for husbands' relationship satisfaction. Further predictors for husbands marital satisfaction were partners' negative dyadic coping, partners' stress communication and own supportive dyadic coping. Whereas the results that less negative dyadic coping by the partner and more stress communication by the partner is associated with a higher level of relationship satisfaction are comparable to other findings reported in the literature (Bodenmann, 1995), our results that husbands' own supportive coping behavior is negatively associated to their relationship satisfaction, is difficult to explain. Based on the available data from our study, it can only be speculated that supportive coping is provided, the need to provide it, e.g., because of an illness of the partner (cf. Martin, Peter-Wight, Hornung, Braun, & Scholz, 2009), may still be experienced negatively. This may be particularly likely in longterm marriages in which the partners feel obliged to support the other and feel that there is no other choice.

As we hypothesized, dyadic coping reported by the partner (actual dyadic coping) explained less variance of one's own relationship satisfaction than self-reported dyadic coping of the partner. Similar finding have been reported by Bodenmann (2000) for young and middle aged couples. He also found that coping reported by the partner explained about half as much of the variance of own relationship satisfaction as self-reported dyadic coping. These results emphasize the idea that social support must be seen as a highly subjective variable (Acitelli & Antonucci, 1994; Sarason, Levine, Basham, & Sarason, 1993). Also, different aspects of dyadic coping seemed to be important when dyadic coping reported by the partner and self reported relationship satisfaction were analyzed. The only significant predictor of husbands' dyadic

coping for wives' marital satisfaction, was husbands' own stress communication. Bodenmann (2000) also found that stress communication reported by the husband predicted wives marital satisfaction. Contrary to our study, common dyadic coping and negative dyadic coping reported by the husband also predicted wives marital satisfaction. Significant predictors of wives dyadic coping for husbands relationship satisfaction were partners' negative dyadic coping and own supportive dyadic coping, in the sense that less negative dyadic coping of the partner and more own supportive dyadic coping led to a higher relationship satisfaction. These results differ from Bodenmann's (2000) results that showed common dyadic coping reported by wives to be the strongest predictor for husbands' relationship satisfaction.

Results in a similar direction, but also interesting differences as for husbands and wives separately, were found on the interdyadic level. Most importantly, the variance in relationship quality explained on the interdyadic level is higher than on the interindividual level. This suggests that future research on dyadic coping needs to include the perspective of actual couples versus examining married individuals only. The larger amount of variance explained is likely to stem from the fact that dyads' relationship quality may depend on the complementary combination of dyadic coping of the two individuals within the dyad, and that it may not be adaptive if both demonstrate equal dyadic coping. Thus, the interdyadic analysis captures some of the dynamics within each dyad. When examined in more detail, the total couple marital satisfaction is best predicted by partner's supportive dyadic coping followed by common dyadic coping and partner's negative dyadic coping. These results are congruent with findings by Bodenmann (2000) showing that for young couples, supportive dyadic coping and common dyadic coping are the most important predictors of their marital satisfaction. Our results are also in line with the findings reported by Schmitt et al. (2007) that show the importance of dyadic interaction (own support, partner's support, role behavior, joint activities) for the relationship satisfaction of middle aged and older couples. Unfortunately, with our study we cannot make conclusions about the direction of the effect. It remains unclear if couples dyadic coping influences their relationship satisfaction, if the relationship satisfaction influences couples dyadic problem solving process or if there is an interaction of both. Nevertheless, a two-year longitudinal study by Bodenmann, Pihet, & Kayser (2006) with young couples shows the influence of dyadic coping on relationship satisfaction. Supporting these findings, Bodenmann, Charvoz, Cina, & Widmer (2001) showed in a one year follow-up study that a "couples coping

enhancement training" led to a meaningful improvement of relationship satisfaction. However, only future longitudinal studies allowing to examine the longitudinal changes in intradyadic changes in dyadic coping differences will allow to determine to which degree intradyadic adaptation processes may lead to a stabilization of relationship quality and to compare the dynamics in young, middle-aged and older couples.

Confirming our second hypothesis, perceived reciprocity in supportive dyadic coping (Acitelli & Antonucci, 1994) was significantly correlated with relationship satisfaction of older couples. Post hoc analysis showed that perceived reciprocity in stress communication was also associated with relationship satisfaction (less strongly than supportive dyadic coping). This result is in line with studies that showed that for marital satisfaction it is highly important that partners believe that they are reciprocal (Acitelli, Douvan, & Veroff, 1993) and with studies on perceived equity (Walster et al., 1978). In this study we did not analyze actual reciprocity (comparison of two separate self-perceptions; Acitelli & Antonucci, 1994), but several studies have shown that perceived reciprocity (based on one spouse's report) is more important than actual reciprocity for marital satisfaction (Antonucci & Israel, 1986; Gmelch & Bodenmann, 2007; Ingersoll-Dayton & Antonucci, 1988; Wethington & Kessler, 1986).

Overall, our results suggest that dyadic coping could be an important resource for older adults in long-term marriages. Analysis on the interindividual and the interdyadic level showed similar, but not identical results, which demonstrated the importance of looking at both level when analyzing dyads. The perception of partners' coping as well as perceived reciprocity seem to be of particular importance for older couples' relationship satisfaction. Even though we did not use an actor-partner interdependence model to analyze our date and therefore were confronted with some methodological problems (deletion error; see Gonzales & Griffin, 1979), we did use within-subject analysis when comparing means in order to account for the dependency of the data and we carefully interpreted the results knowing that the variables used were influenced by individual and dyadic factors. The methodological problems that emerged in this study and often emerge in studies analyzing dyadic data will be further discussed in chapter 6.3.

5 Study 4

5.1 The 3-phase-model of dyadic adaptation to dementia: Why it might sometimes be better to be worse[4]

5.1.1 Introduction

Most models dealing with caregiving in dementia have focused either on the caregiver and the burden involved in providing support for a partner with dementia or on the course of decline in functioning and autonomy in the person with dementia (for a review see Braun et al., 2009). In this paper, we present a conceptual model that emphasizes the dyadic perspective on caregiving and care receiving when the individual autonomy of the partner with dementia becomes increasingly compromised. The model suggests that with increasing losses of the patient's individual autonomy, dyadic autonomy and wellbeing can be maintained through different adaptive processes depending on the amount of individual autonomy loss. We will argue that based on the model in some instances dyadic autonomy may be better achieved when individual autonomy is lower than would be predicted from the severity of the illness symptoms. We will start with a short description of the phenomenon of dementia, its progression, and its consequences for autonomy and wellbeing from a dyadic perspective and then briefly describe our theoretical 3-phase-model of dyadic adaptation to dementia. We will then discuss how existing theoretical concepts map onto our model and finally suggest consequences for future interventions and research. We are thus applying major concepts such as equity theory to better understand the dyadic dynamics in the course of dementia. The combination of the 3-phase-model approach with major dyadic exchange concepts provides a novel perspective on a theoretical as well as a practical level.

Dementia is a progressive disease, and a number of established diagnostic rating scales describe the changes in symptoms in consecutive phases. For instance, the Global Deterioration Scale (GDS; Reisberg, Ferris, de Leon & Crook, 1982) roughly distinguishes 7 phases, in which phases 1-2 refer to no or questionable impairment, 3 to mild impairment, 4-5 to moderate impairment, and 6-7 to severe impairment. Clearly these phases have mostly descriptive

[4] A similar version of this chapter has been published in the "European Journal of Ageing" (Martin, Peter-Wight, Hornung, Braun, & Scholz, 2009)

purposes and tend to underestimate the large variability in individual trajectories and symptom combinations. However, for the purposes of this paper they suggest that in the course of the illness progression the autonomy of an affected individual may be roughly described as mildly, moderately, and severely compromised. Generally speaking, from a dyadic perspective the increasing loss of individual autonomy related to the progressing dementia results in increasing and changing needs for instrumental support and care from the spousal partner to maintain dyadic autonomy.

5.1.2 3-phase-model of dyadic adaptation to dementia

The findings on the impact of caregiving for a partner with dementia in old age are equivocal. Most studies suggest that caregiving for dementia patients by older spouses is associated with higher levels of stress and negative consequences on the caregiver's physical and mental health (Adams, 2008; Barnes, Given & Given, 1992; Pinquart & Soerensen, 2003; Schulz, Visintainer, & Williamson, 1990; Vitaliano, Zhang, & Scanlan, 2003). In addition, spousal caregivers face changes in the marital relationship. Partners of dementia patients report various domains of loss in the relationship with the patient: emotional closeness and intimacy, having a helpmate, mental stimulation, or recreational companionship (Mittelman, Zeiss, Davies, & Guy, 2003). Thus, with the onset of dementia the exchange and assistance towards each other in a spousal relationship can become asymmetrical and unequally balanced. As dementia lasts and/or progresses, patients need constant and increasing instrumental, emotional, and cognitive support and they are at the same time less able to reciprocate these exchanges. However, there are indications that some spousal caregivers manage to maintain well-being and health in the face of a progressing illness. Heru, Ryan, and Iqbal (2004) examined spousal dementia caregivers of moderately disabled partners and found that some carers perceived more reward than burden. Furthermore, the caregivers' quality of life was similar to a control sample indicating that spousal dementia caregiving can also be personally rewarding. Additionally, both negative and positive changes experienced by caregiving spouses may coexist (Narayan et al., 2001). In fact, spouses may report perceiving caring as self-fulfilling, satisfying, and affirming while concurrently experiencing negative responses, such as relational deprivation with their partner. That is, although the majority of carers perceive a deterioration of their relationship, at the same time they may report feeling closer to their spouses now than in the past (DeVugt et al.,

2003).

In what follows, we argue that existing theoretical approaches could profit from taking the dyadic consequences of the progressing nature and qualitatively different phases of dementia into account. We will discuss how the most prominent approaches to conceptualize dyadic dynamics are related to adaptive changes that may be observed in affected dyads. Specifically, we point out how the dyadic concepts of coping, problem-solving, equity, reciprocity, and cohesion may apply to explaining optimal processes for adaptation for different phases of illness severity. We will first describe the 3-phase-model of adaptation to dementia and then discuss how each of these existing concepts can be used to derive specific predictions for each phase.

It seems obvious that dementia negatively affects the abilities needed to cope with obstacles and stressors in one partner and that one may, as a consequence, expect lower levels in well-being in both partners. The basic model explaining the effects of long-term stressors on caregivers has been the wear-and-tear model. The model suggests that levels of physical and psychological health decline gradually with the length of care (Haley & Pardo, 1989; Townsend, Noelker, Deimling, & Bass, 1989). However, longitudinal data bearing directly on the wear-and-tear model are ambiguous (Alspaugh et al., 1999; Danhauer et al., 2004; Gaugler, Davey, Pearlin, & Zarit, 2000; Neundorfer et al., 2001; Powers et al., 2002; Schulz & Williamson, 1991). On one hand, stressors such as behavioral problems exhibited by the care recipient as well as role captivity and role overload of the caregiver are predictors for health-related outcomes such as depression in caregivers after controlling for the duration of the illness (Pearlin et al., 1990). On the other hand, depression and role captivity remained stable over time in caregivers (Aneshensel et al., 1995). As caregiving continues into later stages of the illness, overall subjective stress and depression in the caregiver do not seem to intensify past the middle stages of AD in the care recipients (Danhauer et al., 2004; Gaugler et al., 2000). Thus, the wear-and-tear model of caregiving is only weakly supported. Therefore, it needs to be explained why and how some spousal dyads manage to maintain high levels of well-being in the face of increasing losses of autonomy of the patient and increasing and changing demands on the caregiver.

Old couples are also likely to share a history of joint problem-solving and coping, and of adapting their interactions appropriately around events such as childbirth or retirement (e.g., Martin & Wight, 2008). Berg and Upchurch (2007) recently presented a model describing dyadic developments and changes experienced by couples with one partner suffering from a chronic

illness. The authors emphasize that being confronted with a chronic illness of one partner leads to dyadic coping processes that change over the life span. They outline the relevance of focusing on the dyadic perspective (e.g., dyadic appraisal, dyadic coping) in caregiver research. However, the progressive nature of dementia and the cognitive impairments of patients with dementia makes this illness and the required adaptational processes unique compared to other chronic illnesses, and it is consequently not part of the review. From a psychological point of view, a model addressing dyadic adaptation processes in dementia must specify under which conditions old spousal dyads affected by the onset and progression of losses of individual autonomy caused by the dementia may adapt their interaction patterns to stabilize their dyadic autonomy, i.e., independence from external help and well-being. The empirical findings based on existing theoretical models of dyadic exchange or caregiver burden may partly be due to the fact that dyads of varying levels of dementia severity and caregivers with varying durations and amounts of caregiving, symptoms, and study onset have been examined (e.g., Gaugler et al., 2000). To provide a framework for these seemingly equivocal empirical findings, we suggest a 3-phase-model of dyadic adaptation to dementia that takes the progressing nature of the illness, the dyadic nature of the effects of the illness on individual autonomy and well-being of both partners, and the adaptational potential of affected dyads into account. We argue that existing theoretical approaches could profit from taking the phase concept presented here into account, because it may help to make more specific predictions about processes potentially contributing to the maintenance of dyadic autonomy and well-being when confronted with dementia. Some existing models may apply well to specific phases, and some models will make different predictions about optimal processes for adaptation for different phases. The model is displayed in Figure 1 and described in Table 14.

Figure 1: The 3-phase-model of dyadic adaptation to dementia

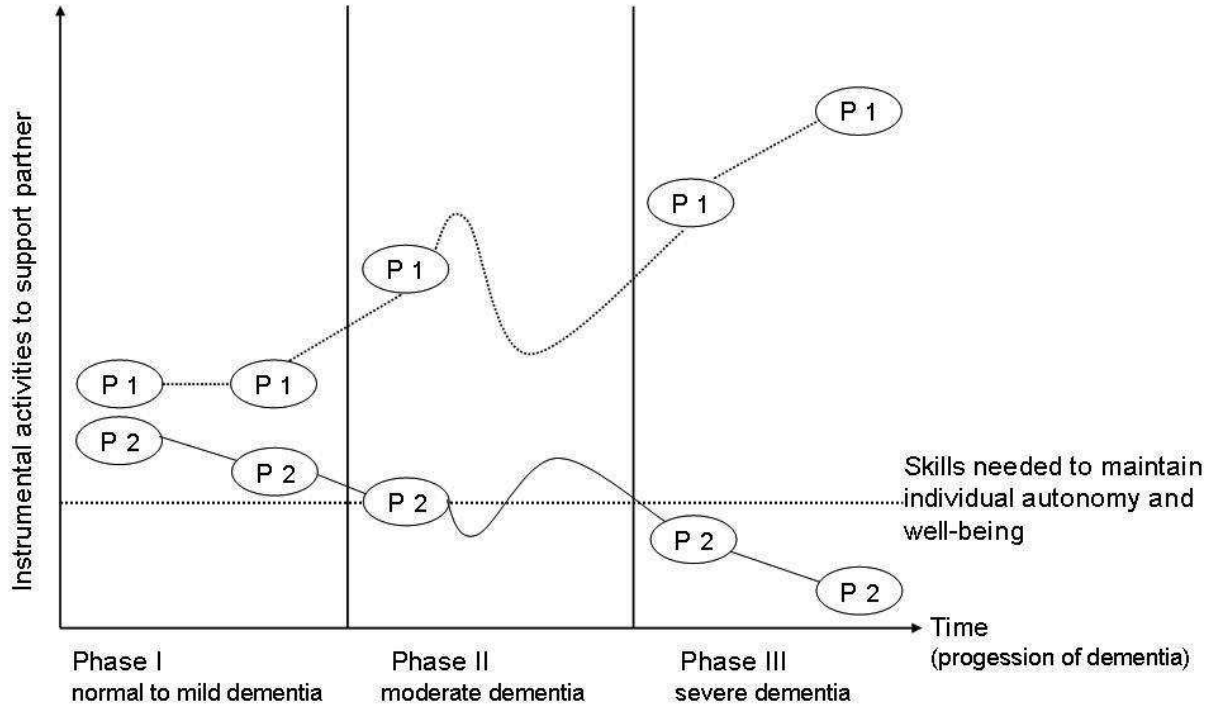

Table 14: Assumed rules for social dyadic exchange and strategies to maintain normal well-being depending on dementia severity

	Phase I	**Phase II**	**Phase III**
Assumed best rule for dyadic exchange	Equity	Adaptation	Needs
➔Support activities P1	Average	High	Extreme
➔Support activities P2	Average	Moderate	Low
Individual autonomy P1	High	Low	High
Individual autonomy P2	High	Moderate	Low

Requirements for dyadic autonomy	Maintain individual autonomy	Frequent assessment of abilities and needs of partner Coping strategies	Reappraisal
Assumed best cognitive strategies	Individual problem-solving	Dyadic problem-solving	Individual-led task management
Strategies to enhance cohesion	Interdependence Communal orientation	Commitment Communal orientation	Willingness to sacrifice External support
Outcome: Dyadic autonomy and well-being	Normal	Normal	Normal

Note. P_1 *= Caregiving partner;* P_2 *= Care receiving partner, partner with dementia*

On the one hand, we assume that decreases in individual autonomy related to increases in dementia severity from Phase I to Phase III lead to increases in imbalance which in turn impacts couples' and, more so, caregiver's well-being. Thus, we hypothesize that dyadic exchange has a mediating function between increasing severity and well-being. On the other hand, we assume that a couple's adaptive capacity serves as a moderating factor for the association between dementia severity and well-being. The couple's adaptive capacity is expressed in increased transformations in relationship-supporting processes due to the change in dementia severity from Phase I to Phase III of the spouse. Relationship-supporting processes in close and long-term relationships involve dyadic problem-solving, growing commitment and interdependence, communal orientation and willingness to sacrifice as well as past and present marital functioning. Dyadic exchange may directly mediate an association between severity of dementia and well-being or it is adapted to the progressive nature of dementia, resulting in a mediating function of *changes* in dyadic exchange between progressing dementia severity and well-being.

Generally, the model assumes that, first, different activities and strategies are required in the different phases of progressing losses of individual autonomy related to dementia in order to achieve stable levels of dyadic autonomy and well-being. Second, it assumes that dyads differ in the degree to which they are able to respond to these changing requirements. Third, the model suggests that each phase carries different risks for the spousal dyads. While one may assume that a main problem in Phase I may be the identification or diagnosis of the illness itself, the model

suggests that the most demanding phase may be the moderate stage in which the ill partner fluctuates in his or her need for instrumental support. In Phase III the highest risk stems from the need to manage practically all aspects of daily life (e.g., household, regulation of affect and social interactions and duration of this requirement). Whereas taking over these responsibilities temporarily is a rather typical experience in life, e.g., in the case of an illness or as the consequence of an accident, the ongoing demands at that level may increase the likelihood for secondary risks such as social isolation, lack of social support, or health problems. In short, the 3-phase-model focuses on the dynamic adaptation of caregiver-care recipient dyads. It assumes that adaptation processes of afflicted couples depend on several individual *and* dyadic factors, such as dementia severity, social support, or imbalanced dyadic exchange. In the following sections, we will discuss how existing theoretical concepts map onto the 3-phase-model and outline the model of dyadic adaptation in more detail.

5.1.3 Models of equity and reciprocity and dyadic exchange across the three phases

In a close relationship with intact levels of individual autonomy, interactions may be best explained by changes in equity and reciprocity (Baikie, 2002; Blau, 1964; Homans, 1961; Thibaut & Kelley, 1959; Walster, Berscheid & Walster, 1973). According to equity theory, a relationship is imbalanced when the ratio between costs and rewards of one partner deviates from the ratio of the other partner. Individuals receiving disproportionately few rewards are expected to feel under-benefited, and individuals receiving disproportionately many rewards are expected to feel over-benefited. Equity theory further predicts that people who feel inequitably treated in their relationship will become distressed (Walster et al., 1973). These distressing emotions can lead both partners in an inequitable situation to work either to restore real, actual equity by changing the balance of costs and rewards, to restore psychological equity by changing their own perceptions and those of the partner in order to make balance seem fair, or to end the relationship (Walster, Walster, & Berscheid, 1978). Relationships vary in the degree of reciprocity in the exchange process. However, equity theory suggests that long-term intimate relationships are less subject to the norm of immediate reciprocity than casual relationships or relationships in the early stages of development (Antonucci, 1990). Thus, a spouse's care for a sick partner represents a continuation of the ongoing exchange that occurred over the course of their

relationship. Relationships based on more general reciprocity can endure one-way flows of help for a sustained length of time. Only if the norm of reciprocity is violated over the long term, the relationship may become intolerably burdensome and stressful (Call et al., 1999).

Very little is known about equity within relationships of couples who have to cope with the development of a serious illness in one partner (Kuijer, Buunk, Ybema, & Wobbes, 2002). The general case may be that healthy partners' contributions to the relationship increase, whereas the ill partners' contributions may decrease because of physical and cognitive limitations and emotional strains (Cutrona, 1996; Thompson & Pitts, 1992). In terms of equity theory, the assumption can be made that couples facing a serious illness will become inequitable (imbalanced) in such a way that ill partners are likely to feel over-benefited and their healthy partners are likely to feel under-benefited. Inequity will lead to lower well-being and relationship satisfaction (McCulloch, 1990; Murstein, Cerreto, & MacDonald, 1977; Rook, 1987; Sprecher & Schwartz, 1994; VanYperen & Buunk, 1994).

How can equity and reciprocity be fruitfully adapted within the 3-phase-model? One may assume that a rule of equity and a norm of reciprocity are highly adaptive when both individuals in the relationship are in principle able to function autonomously, because they provide rewards for independence. Consequently, it should be most adaptive for the dyadic autonomy and well-being in Phase I if spousal caregivers maintain their own level of autonomy instead of supporting the partner unnecessarily, thus avoiding over- and under-benefiting in the relationship. However, in Phase II with intermittent times of clear need for support and in particular in Phase III with constantly high levels of need of support, equity and reciprocity may not be possible any more.

As already mentioned, Walster et al. (1978) suggested three possible reactions to inequity in relationships. Applied to social exchange within couples in which one partner is suffering from dementia, this suggests that not all strategies are equally likely to be successful. In addition, the selection and use of particular strategies depend on available cognitive abilities to jointly solve everyday problems. Restoring actual equity may be particularly difficult when inequity is caused by unchangeable characteristics of the illness as in Phase III. Ending the relationship is probably not a realistic option for long-term married couples who tend to have a high commitment towards marriage (Rusbult & Buunk, 1993). Therefore, from the dyadic perspective of the 3-phase-model psychological restoration in terms of changing perceptions may be the most adaptive response (Sprecher, 1992). Psychological restoration may include reappraising

domains of reciprocity, e.g., a balanced exchange of emotional support may compensate for an imbalanced exchange of instrumental support. In fact, Wright and Aquilino (1998) demonstrated that the care recipient's supportive behavior influences caregiver well-being and relationship satisfaction. The more emotional support was reciprocated the less was the subjective burden and the higher the marital satisfaction. In addition, the results indicate that receiving support and help from the care recipient enhances the well-being of the caregiver. In contrast, the impact of emotional support exchange was the same across different types of disabilities indicating that an imbalanced exchange increased the subjective burden for the caregiver. Nonetheless, when high levels of disabilities are present as in Phase III, the effect of reciprocal exchange on burden diminishes, and caregiver burden is nearly constant regardless of the number of balanced exchanges (Wright & Aquilino, 1998). In sum, despite the potential benefit of restoring perceived equity in a long-term caregiving relationship in which the partners become increasingly interdependent and committed towards each other, it is not clear under which circumstances restoration is adaptive and how dyads could be supported in using this strategy.

5.1.4 Models of cognitive collaboration across the three phases

It may be assumed that dyadic problem solving and the negotiation and distribution of responsibilities within old couples provides an enormous potential for adapting to a situation in which one partner becomes chronically ill, and consequently, a number of studies have examined the adaptation to chronic illnesses (for an overview see Berg & Upchurch, 2007; Bodenmann, 2005). There are very few studies on adaptive collaboration in partners with dementia, because the cognitive impairments represent both a critical event like any other chronic illness and an impairment of the cognitive abilities needed to adapt to the situation in one partner (see Berg & Upchurch, 2007). As the sharing of responsibilities and management of problem solving puts a cognitive load on both partners, this should become increasingly difficult as the cognitive impairments increasingly limit the part being shared by the partner with dementia. In fact, when comparing older dyads' dyadic cognitive performance to nominal group performance, i.e., the pooled, non-redundant performance of two individuals, real dyads typically perform worse than nominal dyads (Andersson & Rönnberg, 1995; Basden, Basden, Bryner, & Thomas, 1997; Johansson et al., 2005; Ross et al., 2004). Based on this finding, a very efficient strategy in Phase I would be the attempt to independently solve problems that each partner is confronted with and

to communicate about the best possible solution (see Martin & Wight, 2008). In Phase II, it seems most adaptive to renegotiate responsibilities for everyday tasks such as medication regimens and life management to adapt to the changes in abilities in one partner. Consequently, focusing on coping with the situation "as a team" may support dyadic cohesion despite the partner's declines in cognitive abilities. In Phase III, the most adaptive strategy for the partner without dementia would be to take over the lead in solving everyday problems to allow a focus on the exchange of emotional feedback between partners to stabilize the relationship (Wright & Acqilino, 1998).

5.1.5 Models of marital functioning and cohesion enhancement across the three phases

Marital functioning may become disrupted in spousal dyads due to the fact that the ill partner cannot maintain the spousal relationship as before. In the framework of general systems theory three core dimensions have emerged which have been integrated into the Circumplex model of marital and family functioning by Olsen (1989). The core dimensions are cohesion, adaptability, and communication. Marital cohesion is defined as the degree of emotional bonding or support spouses provide toward one another. Marital adaptability is the ability of spouses to change the power structure, role relationships, and relationship rules in response to situational and developmental stress and therefore focuses on the ability of the spouses to change. Marital functioning is thus dynamic responding to stressors over the life course resulting in corresponding changes in the couple's styles of cohesion and adaptability.

In the context of dementia caregiving, the spousal caregiver has to cope with the increasing loss of shared intimacy and emotional support in the relationship with the ill spouse. Coping with loss, therefore, requires a capacity to relinquish attachments and gain emotional distance. At the same time, a couple's natural response to progressive illnesses such as dementia is toward increased cohesion, often creating a dilemma where the caregiving spouse is likely to be pulled in opposite directions. Adaptability or the spouses' ability to modify roles and responsibilities within the marriage also becomes critically important in dementia (Rankin, Haut, & Keefover, 2001). This requirement is most obvious in Phase II in which the partner has to constantly re-assess the needs of the ill partner and to ideally respond with a maximum support for the individual autonomy of the ill partner. Empirically, Rankin, Haut, and Keefover (2001)

examined the relation between current marital functioning and caregiver depression in spousal caregivers. Results indicated that losses associated with emotional rather than instrumental support were more salient in understanding depressive reactions in spousal caregivers. Marital cohesion (intimacy and emotional support) rather than the caregiver's perceptions of marital adaptability (role structure and responsibilities) emerged as the important factor in predicting caregiver outcomes associated with marital functioning. While spousal caregivers may be able to compensate for their spouse's functional deficits (e.g., capacity to participate in decision-making activities) and instrumental decline (e.g., cooking, driving) without major psychological distress, losses of intimacy, and companionship were not as easily tolerated (Rankin et al., 2001). In fact, the absence of perceived cohesion within the spousal relationship may lead to multiple grief reactions among spouse caregivers. These may include the loss of a core relationship, loss of self (i.e., self as spouse), and loss of the "idealized" relationship (Rankin, 1994).

Thus, Phase II is characterized by the highest cognitive demands on dyadic problem-solving, the highest burden on assessing the needs of the ill partner and tailoring the optimal mix of coping strategies, and the highest burden on marital cohesion. From a resource standpoint, it may be speculated that higher levels of individual dependence (as in Phase III) would be more adaptive for relationship quality and stability in spouses with one partner suffering from dementia. If the partner with dementia would behave more dependently, it would reduce the burden of the healthy partner to constantly assess the current need levels of the ill partner and to constantly match support to current need levels at the cost of more instrumental support than would be required on the basis of the existing abilities of the ill partner. One may assume that within some couples, there may be a tendency to reduce assessment burden whereas in others there may be a tendency towards maximum individual autonomy of the partner with dementia. Thus, in this sense and given no external support, it may sometimes be "better to be worse" to stabilize the relationship and the dyadic well-being (see also Baltes, 1996; Baltes & Wahl, 1996 for dependence support scripts in professional care). However, at this point there are no longitudinal data to test this assumption. In addition, if this assumption is true, then it would not so much be the caregiving itself, but rather the cognitive costs of constant need assessment and constant support-tailoring in Phase II that may lead to an increased relationship stress that causes the observed health outcomes in dementia-caregiving spouses. Thus, it needs to be shown to which degree assessment support and tailoring support may reduce the relationship stress on

caregiving spouses. In any case, our 3-phase model makes testable predictions that seem counter-intuitive from the standpoint of a stress x coping framework on caregiving stress.

5.1.6 Strategies related to dyadic cohesion across the three phases

Communal orientation in long-term relationships. Communal relationships can be viewed as relationships characterized by long-term reciprocity in their exchange pattern. Due to the long-term communality between partners, they become sensitive to the needs of one another. Caregiving couples in highly communal relationships feel responsible for the welfare of the other partner and do not feel exploited when the other partner cannot reciprocate the help received (Williamson, & Schulz, 1995). Caregivers in highly communal relationships less likely attribute distress to the care recipient than to the illness condition (Williamson, Shaffer, & the Family Relationships in Late Life Project, 2001). Although highly communal caregivers will experience depressed affect, these emotions should be directly related to the loss of the couples' interpersonal interactions rather than being related to perceived burden. Pre-illness as well as present high communality in caregiving relationships may determine caregiving outcome for both the caregiver and the care recipient (Williamson & Schulz, 1990; Williamson, Shaffer, & Schulz, 1998). Findings based on the theory of communal relationships indicate that communal partners do not feel exploited when one partner cannot reciprocate aid to the other partner (Clark & Waddell, 1985) and they are more inclined to feeling good after having helped their partners (Williamson & Clark, 1992). Thus, in historically communal spousal dyads, providing care simply means continuing to meet the other's needs as those needs arise, knowing that the partner would do the same if the situation were reversed. Although these caregivers may be saddened by watching a spouse decline in health and by losses in the rewarding aspects of their previous relationships, they remain generally concerned about providing the quality of care necessary to ensure the partner's welfare (Williamson & Shaffer, 1998). Findings also suggest that, when pre-illness marital relationships are characterized by fewer mutually communal behaviors, caregivers may experience depressed affect because they are neither accustomed to meet their partner's needs on a regular basis nor to having their partners attend to their own needs (Williamson & Shaffer, 1998). Furthermore, less communal caregivers are likely to provide care more out of duty or obligation than concern for the recipient's welfare (Williamson & Schulz, 1995). Although caregivers in pre-illness communal relationships are genuinely concerned with the

welfare of the partner, they will still miss the intimacy and mutual concern that may no longer be apparent in the relationship and therefore will experience some depressed affect as a result of this interpersonal loss. Williamson and Shaffer (1998) reported that depressed affect among caregivers in highly communal relationships was directly related to deterioration in the couples' interpersonal behavior and interactions. By contrast, caregivers whose relationship with the care recipient has been historically characterized by less communal behavior may perceive providing care as burdensome. Furthermore, partners can become so linked, to the extent that a departure from self-interest that benefits the partner may not be experienced as a departure from self-interest (van Lange et al., 1997). This shift towards a communal orientation of a relationship may help to enhance the willingness to sacrifice for the partner or the relationship, due to the fact that they do not differentiate between what is good for them and what is good for the relationship. Based on the reciprocity of communal orientation, communality should be most adaptive in the transition from healthy to mild forms of dementia (Phase I), but also supporting adaptive processes in Phase II to the degree of independence of the ill partner and Phase III with respect to the enhancement of willingness to sacrifice.

Interdependence and commitment in close relationships across the three phases. As partners become more interdependent in Phase I, it would be most adaptive if partners depart from acting on the basis of their own self-interest and instead tend to act on broader goals associated with the relationship. Within close long-term relationships, partners should become more interdependent and they should move from concern with self-interested preferences to concern with mutual outcomes for self and partner, which goes along with increasing commitment in Phase II (Kelley, 1979; Kelley & Thibaut, 1978).

Commitment is a central motive in ongoing and long-term relationships (van Lange et al., 1997). Commitment may be explained by the fact that in long-term relationships, engaging in relationship-supporting behaviors on earlier occasions may lead to direct personal benefit on later occasions, when a partner feels inclined to reciprocate (Axelrod, 1984). In addition, relationship-supporting behavior may communicate a committed person's co-operative, long-term orientation – in such that behavior that is contrary to self-interest may provide evidence of an individual's feelings toward the partner (Kelley, 1979). As a result, as relationships become more committed they become less exchange oriented and closer to a communal orientation of their relationship (Clark & Mills, 1979). In general, in these long-term involvements individuals

have a sense that their relationship will go on for some time into the future. Thus it becomes less essential that they immediately get out of it equal to what they put in (Whitton et al., 2002). This seems particularly adaptive in Phase II. Spouses in long-term marital relationships are often highly committed and thus more easily accept imbalance of social exchange. Subjective commitment summarizes the nature of an individual's dependence on a partner and represents broad long-term orientation towards a relationship. Strong commitment also promotes a variety of relationship maintenance behaviors. Commitment processes are explained by referring to the structure of an individual's interdependence with a partner (Rusbult & Buunk, 1993). Commitment summarizes prior experiences of dependence and directs reactions to new situations (e.g., willingness to sacrifice when outcomes are non-correspondent as in Phase III). It represents a long-term orientation, including feelings of attachment to a partner and the desire to maintain in a relationship, for better or worse. In fact, in Phase III high levels of commitment predict tendencies to engage in relationship-supporting behaviors, even when such behaviors are costly and stand in opposition to direct self-interest. Thus, interdependence and commitment are adequate strategies to explain optimal adaptation to dementia in spousal dyads in Phase I and Phase II, and to the degree of dependence of the ill partner in Phase III.

Willingness to sacrifice in close relationships across the three phases. Associated with the development of a long-term orientation of a relationship and the shift towards a communal orientation in the relationship is a growing willing to sacrifice for the relationship (Whitton et al., 2002). Sacrificing means to forego self-interest to benefit the partner or maintain peace in a relationship (Whitton et al., 2002). These acts of sacrifice are intended to promote the well-being of a partner or the relationship and involve the departure of a priori, self-interested preferences (Van Lange et al., 1997). Willingness to sacrifice is positively associated with higher levels of dyadic adjustment, strong commitment, and higher relationship satisfaction (Whitton et al., 2002). Van Lange et al. (1997) assume that commitment promotes willingness to sacrifice and that sacrifice in turn strengthens the couple's functioning. This should be particularly important the more the dyadic autonomy depends on one partner taking over the responsibilities for daily functioning, i.e., in Phase III as actual equity cannot be restored.

5.1.7 Research implications

We have presented a 3-phase-model of dyadic adaptation to dementia, assuming that with

the increasing loss of individual autonomy in one partner different requirements have to be met to achieve a maximal level of dyadic autonomy and well-being. We have tried to demonstrate that existing theoretical concepts can be mapped onto the 3-phase-model, and that using existing models to specify hypotheses about adaptational processes of dyads adjusting to the changing needs with increasing losses of autonomy through three phases leads to new and partly counterintuitive predictions from an individual perspective.

It must be noted that presenting a general phase model of dyadic development has some obvious limitations. The three phases of individual autonomy loss are necessarily a simplification of the variability of the phenomenon of old dyads affected by dementia. The phases may suggest a normative flow for each affected individual and dyad and an underestimation of the variability in the trajectories of adaptation. Another point to consider is that we have purposely focused on the dyads as the unit of analysis. On one hand, this increases the potential heuristic value of the model. On the other hand, it leaves open the possibility that the dynamics of adaptation depend on the specific situation of married dyads, e.g., because married individuals can only adapt their behavior within the limits provided by their feeling of obligation towards their spouse whereas that may not be true for unmarried dyads or friendship relationships. Generally, we believe the consideration of the changing requirements presented by dementia as a progressing illness affecting cognitive and communication skills will in both cases also create adaptational pressure, but with other behavioral options, e.g., terminating the relationship, the model might have to be specified further. As a general model, it is flexible enough, but it clearly will have to be specified in the future, how the predictions differ when other and larger numbers of social network partners are included in such a model. What is more, our focus on the dyad has not allowed us to include aspects of extra-dyadic resources such as other familial and non-familial social partners, professional carers, or financial resources, and this clearly limits the generalizability of our suggestions. Nevertheless, we have tried to demonstrate that the integration of a developmental and a dyadic approach combined with a focus on an actively adapting dyad provides important new avenues for future theoretical and empirical work on the dyadic orchestration of resources to maintain autonomy and well-being in old age. The model provides a conceptual basis to integrate theories and empirical findings on the effects of caregiver burden and health, the effects of relationship-supporting processes designed to facilitate the achievement of relationship equity, and on the effects of relationship

dynamics on the dependency behavior of individuals suffering from dementia.

Overall, adaptive processes seen in pro-relationship transformations in close and long-term relationships seem to function as moderator for the association between increasing losses of individual autonomy related to dementia severity and well-being across three phases of dementia. Spousal dyads may revert to processes which are inherent to close and long-term relationships. Within the caregiving context transformations towards stronger pro-relationship behaviors may become more important. Those relationship-supporting behaviors such as dyadic problem-solving, growing interdependence, commitment, communal orientation, and willingness to sacrifice as well as the dynamics of marital functioning may shape the couple's adaptive capacity to maintain spousal exchange on other grounds than equity exchange and may function as moderator between severity of dementia and well-being.

The 3-phase-model has the advantage of providing a conceptual framework to identify particular research needs for the transition to increasing levels of individual autonomy loss related to mild, moderate, and severe dementia. For Phase I, it requires the longitudinal examination of dyadic dynamics at the onset of dementia. Typically, this group is underrepresented in dementia research, because inclusion criterion for most studies is an available diagnosis. However, individuals with a diagnosis in such an early stage are rather exceptional. In addition, Phase I characteristics as described by the model suggest that focusing on the well-being of the non-demented partner seems to be the optimal strategy for maintaining dyadic well-being. Empirical data are needed to examine interdyadic and interindividual differences in knowledge and use of this strategy and their relation to intraindividual and intradyadic well-being. For Phase II the model makes different predictions. That is, the model suggests that the spouse with dementia may be pushed towards increased dependency. Although from an individual perspective this may increase the burden on providing instrumental support by the non-demented partner, from a dyadic perspective it reduces the ambiguity and effort related to performances above and below thresholds of individual autonomy (i.e., when on "good days" the patient may be able to perform behaviors independently, on "bad days" may need assistance), may stabilize external support as well as a focus on intradyadic emotional support. A similar case has been made for caregiving relationships of professional carers (Baltes, 1996; Baltes & Wahl, 1996). For Phase III, the model again makes different predictions. It suggests the key importance of external support when severe dementia is lasting over extended time periods.

Although from an individual perspective external help would be the optimal match for the needs of the partner with dementia, from a dyadic perspective the model predicts that external help may only be acceptable to the degree that it does not endanger dyadic autonomy, commitment, or the willingness to sacrifice. This would be the case with particular conditions related to the progression of the illness such as the beginning and ongoing of incontinence. However, empirical research is necessary to determine what factors increase acceptance of use of external support by the partner with dementia and thus improve well-being in the non-demented partner. This, in turn, might positively influence the dyadic well-being by allowing the spouse with dementia to display autonomous behaviors without risking negative social consequences for the non-demented partner.

To investigate the adaptation of affected spousal dyads, both spouses have to be included in future research differentiating between the three phases of dementia progression (see Braun et al., 2009). Since the model makes different predictions with respect to the processes supporting dyadic well-being, these predictions may be tested within cross-sectional studies focusing on samples of spouses in a comparable phase of autonomy loss related to the illness. Moreover, to observe adaptational processes within couples, longitudinal study designs examining dyadic social exchange processes over time will provide an answer to the question of what kind of adaptive processes take place when a dementing illness lasts or becomes more severe in order to maintain dyadic and individual well-being. Given the central importance of Phase II with the highest demands on caregiving spouses, we suggest a focus on this particular phase in which we speculate higher levels of dependence might, in the short term, increase spousal cohesion, but may, in the long term, have negative consequences for both partners.

5.1.8 Potential practical implications

We believe that our 3-phase-model will provide a basis for theory-based development of intervention strategies utilizing the adaptive capacities not only of individuals, but also of the afflicted couples or other social systems. First of all, the model suggests that despite increasing caregiver burden and increasing threats to individual autonomy, through dyadic adaption processes dyads may be successful in stabilizing their dyadic wellbeing. What is more important, it suggests that when dyads are successful in maintaining their wellbeing, then this is due to their active role and not because of some pre-existing constellation of abilities or skills. Thus, the

model implies that adaptation of dyads can be learned and supported, because dyadic wellbeing is not simply a function of existing skills and it acknowledges the enormous efforts of dyad members to maintain wellbeing. Second, the model emphasizes stability as an important outcome of interventions. Whereas in most intervention evaluation studies the goal typically is to improve wellbeing, in the face of dementia a positive outcome may be the stabilization of well-being. Thus, the model allows to frame and justify practical interventions in the area of dementia that focus on the stability of important functional outcomes such as wellbeing or dyadic autonomy. For example, with our model the question becomes how do dyads orchestrate their resources to achieve stable levels of wellbeing versus the question if a particular intervention does on average increase wellbeing. Third, the model suggests that intervention targets in dementia should include the affected dyad versus a sole focus on the affected individual. The model suggests that dyads may prioritize their actions towards maintenance of their dyadic autonomy whereas health care provision prioritizes their actions typically on individual autonomy. To the degree that the consequences for effective support differ, as we have tried to argue, interventions may not be accepted and effective.

6 General discussion

In this chapter the findings from the four studies (chapters 2-5) are summarized and their relevance is discussed by relating them to the presented research questions (chapter 1.3). For the different research areas implications for future research are discussed. The thesis then ends with some methodological concerns when analyzing and interpreting dyadic data and a conclusion that adopts a broader view on the role of social support within couples in old age.

6.1 Summary and discussion of study results

6.1.1 Dyadic cognition in older dyads

The first aim of the present thesis was to review current paradigms and findings in the field of older adults' dyadic cognition in order to find out under which circumstances dyadic cognition can be a resource for older dyads' cognitive performance. It was shown that depending on the particular cognitive task examined, collaboration can have different effects. With respect to dyadic memory performance, older adults' dyadic performance is usually superior to their individual performance. However, compared with nominal performance, real dyads usually generate fewer correct recalls, but also make fewer mistakes (e.g. Ross et al., 2004). Contrary to the results in dyadic memory research, older adults' dyadic planning does not lead to better performance than individual planning, probably because of the relative simplicity of the task. Comparable to the results on dyadic memory, dyadic planning also causes fewer errors than individual planning (Cheng & Strough, 2004). For optimal dyadic decision making on wisdom tasks, an external or internal dyadic discussion should be followed by individual thinking time (Staudinger & Baltes, 1996). Finally, studies on older adults' dyadic reasoning training suggest that dyadic training compared to individual training is associated with better strategy maintenance at a three month follow-up (Saczynski et al., 2004).

Both, studies on dyadic memory and studies on dyadic decision making on wisdom tasks show better dyadic performance when older adults are familiar with each other (spouses, friends) than when they collaborate with a stranger. Regarding dyadic memory, an explanation for this result is that familiar dyads are able to use their transactive memory system. Both partners being well informed about their partner's knowledge has the advantage that they both only have to

encode things that belong to their own knowledge areas and therefore are able to reduce individual work load (e.g. Johansson et al., 2000, see chapter 1.1.1). The familiarity effect on wisdom tasks is more difficult to explain. It is possible that in order to solve social dilemmas a certain openness and honesty that can be better achieved in more intimate dyads is necessary.

In some of the reviewed studies age effects in dyadic cognition were examined. Concerning dyadic memory most studies have shown lower memory performance in older dyads compared to younger dyads, which was explained by differences in interaction styles. Older dyads tended to communicate less efficiently, i.e., use more words, speak more slowly, and support their partners less. On a dyadic planning and a dyadic decision making task Berg et al. (2003) surprisingly did not find more high-affiliation interactions in older dyads than in younger dyads. However, in both age groups, high-affiliation interactions led to better dyadic planning and decision making.

Another interesting finding concerning dyadic planning and dyadic decision making is that men seem to be more influential than women when solving the tasks collaboratively even though women showed the same or better performance than men in the individual situation (Margrett & Marsiske, 2002).

In summary, it is important to note that different paradigms have been used in older adults' dyadic cognition research and it has been shown that collaborative performance varies according to the task at hand. Other factors influencing collaborative outcome are familiarity, age, gender, and dyads' interaction characteristics. The review of dyadic cognition paradigms in study one showed that paradigms rarely allow examining complementary and sequential collaboration such as in complex problem solving tasks. This is surprising given that it is hard to see why dyads should profit from collaboration in simple tasks or tasks that are likely to trigger competition (see chapter 1.2 on process losses during collaboration). In particular in old age and extremely in case of low cognitive resources, the advantage of collaboration lies in the knowing of each other's personal strengths and in the division of the task along these strengths when confronted with complex problem solving tasks. Therefore, in study two by means of a within-subject experiment it was examined if very familiar dyads (i.e., long-term married older couples) can profit from collaboration on a highly demanding problem solving task. On the basis of the findings mentioned above (for more detailed information see chapter 2) it is hypothesized that even though real couples usually perform worse than nominal pairs, under certain circumstances

(long-term married couples who use a transactive memory system, complex problem solving task) real dyads can not only outperform individuals but also nominal pairs.

6.1.2 Dyadic problem solving in older spouses

As described in the chapter above, so far dyadic cognition has been shown to be a resource for cognitive performance only in comparison with individual performance, but not compared to nominal pair performance. Therefore, the second aim of this thesis was to find out if under certain circumstances real dyads would be able to also outperform nominal pairs, i.e., if long-term married, older couples collaborating on a highly demanding problem solving task requiring spatial memory and reasoning abilities would outperform individuals *and* nominal pairs. With a computer-based problem solving task that can most likely be optimally solved when dyads manage to distribute responsibilities between the spatial memory demands and the reasoning demands of the task, with 50 long-term married older couples it was shown that in fact dyads consisting of old spouses outperform old individuals as well as nominal pairs.

Unlike on memory tasks in which the collaboration of a dyad seems to inhibit optimal performance, on a complex problem solving task collaboration gains seem to be higher than collaboration costs. One interpretation of this result is that most tasks used so far in dyadic cognition research required identical abilities to perform well, whereas the problem solving task in our study required the complementary sequencing of memory and reasoning skills, which might suggest to participants that sharing the task according to each partners' capabilities would be beneficial. Another reason for the better performance of real dyads compared to nominal pairs is the long marriage duration of the elderly spouses that makes them "collaboration experts". In fact, most couples reported that their collaboration on the problem solving task was representative of their everyday collaboration, which indicates that most couples have practiced collaboration over the years and therefore have reached a certain expertise. However, further empirical testing with two different age groups, two different tasks, familiar and unfamiliar dyads, and older couples with long and short marriage durations is necessary to definitely find out the reason for optimal performance of the couples in our study. Comparing older spouses to younger spouses and to older unfamiliar dyads as well as to older couples with a very short relationship duration would show if the collaboration benefit found in study 2 is age specific (this would mean that by collaborating older adults compensate for age-related deficits) or

dependent on the level of familiarity (if familiar dyads are better collaborators, this indicates that a certain collaboration expertise leads to the benefit, that the knowledge of each other's strengths and weaknesses is an advantage, or that process losses related to getting to know each other in stranger dyads can lead to a lower performance). By looking at dyadic cognition in different tasks it could be clarified if indeed, as mentioned in study 2, in complex problem-solving tasks, requiring the sequential and complementary use of different cognitive abilities (for example memory and reasoning in study 2), collaboration is more beneficial than in easier tasks requiring for example only memory abilities. Emphasizing the specific requirements of a task, introducing some kind of a collaboration manager or replacing one partner by a virtual partner with specific skills would show if knowing task characteristics, controlled collaboration, or the knowing of only being responsible for a certain aspect of the tasks, positively influences collaborative outcome. Also, it would be important to analyze the interaction of age and communication (verbal and nonverbal) during collaboration. It has been shown that high-affiliation conversations (Berg et al., 2003) and more cooperative interaction styles (Bauert, 2009) are associated with higher collaborative performance. However, it needs to be tested if, as suggested by the theory of socioemotional selectivity (Carstensen et al., 1999), older adults communicate more positively than younger adults and therefore are able to enhance collaboration or if older adults' communication is less efficient and therefore compromises collaborative performance.

6.1.3 Dyadic coping in older spouses

Whereas in study 2 the focus was on older, long-term married spouses' joint completion of a cognitive task, in study 3 the joint handling of everyday problems in intimate relationships was in the foreground. The link between the two studies can be seen in the fact that aspects such as coping and relationship satisfaction (study 3) might also play a role in the collaborative process. In further studies, the following speculations on this link should definitely be addressed. Concerning the association between dyadic coping and dyadic cognition, it seems plausible that spouses who are sensitive to each other's needs and supportive in their coping behaviors are also able to create a fruitful collaboration atmosphere. However, it is also possible that supportively coping spouses are more interested in stabilizing the relationship than in performing optimally. Concerning the link between relationship satisfaction and dyadic cognition, on the one hand it can be assumed that satisfied couples don't have to worry about too much competition between

the partners and therefore are able to focus on the task itself. On the other hand, competition between partners might be an advantage for the collaborative performance and therefore unhappy partners that are interested in "winning" against each other, profit more from collaborating. However, before looking at the association between older couples' dyadic cognition and dyadic coping or relationship satisfaction, with study 3 the third aim of this thesis was to gain knowledge on older, long-term married couples' dyadic coping and relationship satisfaction. Therefore, we examined if older wives' and husbands' dyadic coping strategies are significantly associated with their marital satisfaction, if wives' and husbands' perception of the partner's coping would be more important for their relationship satisfaction than the partner's actual coping, and if, from an interdyadic perspective, older couples dyadic coping strategies are related to the couples' marital satisfaction level. Our results confirm our hypotheses, demonstrating older wives' and husbands' dyadic coping being significantly associated with their marital satisfaction and that especially the perception of one's partner's coping is important for the own satisfaction level. On the interdyadic level, main predictors of couples' relationship satisfaction are partner's supportive dyadic coping, common dyadic coping, and partner's negative dyadic coping. In comparison, interdyadic differences explained more variance in marital satisfaction than interindividual differences.

Even though in general, older husbands and wives were quite satisfied with their marriage, their satisfaction level was below the average relationship satisfaction of the middle-aged norm sample. A reason for this result could be a decrease of marital satisfaction over the lifespan, which has been found by other authors as well (e.g., Van Laningham et al., 2001). However, it is also possible that the questionnaire we used (PFB, Hahlweg, 1996) was not optimal for measuring older adults' marital satisfaction (see chapter 4.1.4).

Concerning the association between dyadic coping and relationship satisfaction there do not seem to be big differences between younger and older couples, i.e., just as for young couples dyadic coping seems to be an important resource for long-term married older couples. However, Bodenmann & Widmer (2000) showed that older couples used less dyadic coping than younger couples, which would mean that older couples lack an important resource for their relationship satisfaction. Further empirical testing with two age groups as well as with old and young short- and long-term married couples would help to find out if marriage duration or age influences dyadic coping and relationship satisfaction. It is thinkable that for long-term married older

couples dyadic coping is even more important than for younger couples (for example because other social support systems are more difficult to reach in old age, see chapter 4.1.1), but it is also possible that long-term married couples do not need as much dyadic coping as short-term married younger couples, for example because they use more individual coping (maybe to not burden the partner). Longitudinal data could show if indeed dyadic coping predicts relationship satisfaction or if people in satisfying relationships are more motivated to cope adequately (see chapter 4.1.4) and if cohort effects play a role for relationship satisfaction. Also, longitudinal analysis would be useful to analyze dyadic relationship developments over the lifespan. Analyses with actor-partner interdependence models (Kenny & Cook, 1999) can test truly dyadic effects as opposed to analyzing groups of individual dyad members (problem of dependence of dyadic data, see chapter 6.3).

6.1.4 Older spouses' dyadic adaptation to dementia

This chapter summarizes and discusses our theoretical model on adaptation processes in dyads confronted with cognitive and emotional impairments. After having empirically tested older, long-term married spouses' interactions in different situations it becomes an important issue to have a conceptual model going beyond individual risk factors. In other words the question is how successful dyadic behavior can be conceptualized. Whereas in study three it was assumed that the more dyadic coping, the better the satisfaction levels of the couples, the dyadic dynamics reported in study 4 and results of study 2 suggest that complementary and sequence management lead to a stable outcome of relationship autonomy and an improved performance. The approach we took in order to model successful dyadic behavior was to consider dyads in which communication patterns would have to change, because the ability level of one member is compromised. Therefore, the fourth aim of the present work was to suggest a theoretical model of dyadic adaptation to dementia-related losses of patients' individual autonomy and discuss adaptive processes in three phases of dementia (mild, moderate, severe) that may allow stable levels of well-being in caregivers over time. The model suggests that with increasing losses of the patient's individual autonomy, dyadic autonomy and well-being can be maintained through different adaptive processes. In phase one of dementia, when the autonomy of both partners is still high and support activities of both partners are average, the best rule for dyadic exchange seems to be a balanced exchange between partners as suggested by equity theory (Walster et al.,

1973, see chapter 5.1.3). In phase two, individual autonomy of the care-receiver is moderate and the autonomy of the caregiver is low, support activities of the healthy partner are high and the ones of the ill partner moderate. The second phase is the adaptation phase. In phase three of dementia, individual autonomy of the healthy partner is high again, where as autonomy and support activity of the care-receiver is low. At this point support activities of the caregiver are extreme and dyadic exchange only functions on the basis of a rule of needs (see chapter 5.1.3). Even though there are drastic changes for both partners in the dyad, the model suggests that over all three phases the dyadic autonomy and well-being can be preserved. However, the model also shows that each phase carries different risks for the dyad and that dyads will differ in the way they are able to cope with the changing requirements. An advantage of the model is that it provides a framework to identify research needs for the individual autonomy loss in the phases of mild, moderate, and severe dementia (see chapter 5.1.7). Also, the model suggests that when dyads successfully maintain their well-being, this is due to their active engagement and enormous effort in the adaptation process. Having this active role in the adaptation process can be learned and can be supported from outside of the dyad and is not simply a function of pre-existing skills. Overall, it is argued that to be effective and accepted, research and intervention should target affected dyads and not only focus on the individual. Future research should also investigate the adaptation of affected spousal dyads including both spouses and differentiating between the three phases of dementia progression (see Braun et al., 2009). Since the model makes different predictions with respect to the processes supporting dyadic well-being, these predictions may be tested within cross-sectional studies focusing on samples of spouses in a comparable phase of autonomy loss related to the illness. Longitudinal study designs examining dyadic social exchange processes will provide an answer to the question of what kind of adaptive processes take place in order to maintain dyadic and individual well-being, when an illness becomes more severe over time.

6.2 Methodological considerations

This chapter gives a brief overview on the three most important methodological problems in the present thesis and in research on dyads and couples in general. The first issue concerns the statistical analysis of dyadic data. From a methodological point of view it is important to note that per definition dyadic data is characterized by a high interdependence. This means that the

behavior of one partner influences the behavior of the other partner and vice versa (Kelly & Thibaut, 1978; cited in Ledermann & Bodenmann, 2006) or/and that both partners are affected by outside influences in a similar way (Woody & Sadler, 2005; cited in Ledermann & Bodenmann, 2006). Dyadic data can be found in personality research (twin studies, adoption-studies), in family research (couples, parent-child relationships), in education research (teacher-student-dyad), or in clinical psychology (therapist-client-dyad). Three types of dyadic variables can be distinguished. Within-dyad variables vary within but not between the dyads (for example gender), between-dyad variables vary between dyads, but not within the dyad (for example relationship duration of couples), and mixed variables vary within and between dyads (age, relationship satisfaction, and intelligence of couples). Mixed variables are used most frequently and Gonzales & Griffin (1997) point out four common error types when analyzing dyadic data. An "assumed independence error" means that dependent data is regarded as independent, for example by analyzing 200 individuals instead of 100 dyads. This kind of analysis leads to progressive decisions when testing the hypotheses. The "deletion error" is the second error type and means the separated analysis of both within-dyad-groups, i.e., only 50% of the sample is examined (for example only the wives of couples). This technique leads to information loss and power decrease, which negatively affects hypotheses-testing. A "cross-level error" (ecological error) exists when in order to analyze associations between variables, mean or sum scores of dyads are used and in the following the correlations are interpreted on the individual level. The forth error type is the "level of analysis error". This error concerns the interpretation of dyadic and individual processes. In dyadic data, no matter if the examination is on the individual level or on the dyadic level, because in both cases individual *and* dyadic processes are relevant, interpretations cannot be reduced on either individual or dyadic processes. In this thesis these methodological issues were mainly relevant in study 3 (dyadic coping and relationship satisfaction), where correlation and regression analysis with spouses were carried out. Even though the dyadic data was interpreted carefully and methods for analyzing dependent data were used, a deletion error could not be excluded. Analyzing husbands and wives separately has possibly led to an information loss. In study 2 we mainly compared means (taking into account the dependency of the data). Among the different models for the analysis of dyadic data that have been discussed in the literature, the actor-partner interdependence model (Kenny & Cook, 1999) seems to be the most interesting (Ledermann & Bodenmann, 2006). In the model a dyad or

a group and not an individual is the object of the analysis (the sample size then refers to the number of couples or groups) and its central components are actor-effects (independent variable influences dependant variable within the same person) and partner-effects (independent variable of one person influences dependant variable of other person). The model also considers interactions between the independent variables, i.e., when estimating actor-effects it controls for partner-effects and vice versa (for a more detailed discussion of the actor-partner-interdependence model see Kenny & Cook, 1999).

A second methodological problem when examining older spouses is that the variables age and relationship duration are often confounded, probably because of practical reasons (old couples who have only been together for a short period of time are sparse). In study 2 and study 3 of the present thesis this was a relevant issue. In study 2 it was found that long-term married older couples collaborated optimally, i.e., their collaborative performance was better than individual and nominal pair performance. However, it remains unclear if this result is due to the old age or to the long–term relationship of participants. In order to further clarify the effects of age and marriage duration on dyadic cognition, studies with samples of young and old, short- and long-term married couples are needed (see chapter 6.1.2 for specific research implications). A similar problem arose in study 3, where it also remains an open question if dyadic coping and relationship satisfaction are only associated in long-term married, older couples or if the association can also be found in older couples with short relationship duration (that in younger couples with shorter and longer relationships dyadic coping and relationship satisfaction are associated has been shown in several studies, see Bodenmann, 2000). It is for example thinkable that dyadic coping becomes more important with increasing relationship duration and that relationship satisfaction of couples that have just met depends on other factors such as partner attractiveness, common interests, and personality.

In this thesis an age by cohort confound, i.e., the problem that age effects are difficult to separate from cohort effects, was an issue in some of the studies on age differences in dyadic cognition summarized in the review article (study 1, see chapter 2.1). In cross-sectional designs in lifespan research this is a serious problem, because age differences in collaborative performance outcomes could also be the consequence of preexisting cohort differences in collaboration (younger dyads collaboration could be worse because of increase in individualization nowadays etc.). Only longitudinal studies would make it possible to disentangle

age and cohort effects and therefore clarify if couples have a certain collaboration-style that remains stable over the lifespan, if adaptation processes in collaboration take place, and if with increasing age collaboration becomes more important and more beneficial.

A third issue that was a problem in study 2 and 3 of the present work and that is often problematic in studies on marriage, concerns sample recruitment. Instead of looking for a representative sample, most studies on couples use convenience samples. The disadvantage of these studies is that healthy (particularly important when testing older couples), happy, and educated couples are more often willing to participate and therefore badly functioning marriages are under-represented in most studies. In study 2 (see chapter 3) the convenience sample could have led to an over-representation of good collaborators and in study 3 (see chapter 4) older adults dyadic coping and relationship satisfaction could have been overestimated, which makes the generalization of the results difficult. However, with 50 couples in a within-subject experimental design (study 2) and 138 couples in study three, sample sizes were relatively large, which again enhances external validity. Consequentially, studies with representative samples of older spouses are needed in order to get an objective picture on dyadic interactions of older, long-term married couples.

6.3 Conclusion

In the present work it has been shown that dyadic interactions such as dyadic cognition and dyadic coping can be considered to be resources for cognitive performance and relationship satisfaction of spouses aged about 60 and older. Even though the emphasis was on healthy couples' resources, study 4 was an extension into the field of clinical psychology and showed from a theoretical perspective how dyadic adaptation, in case of one partner being affected by dementia, can be a resource to stabilize couples' well-being. In the broadest sense it can be said that the focus of the thesis was on spousal social support in the contexts of cognition and relationship satisfaction. It was attempted to look at cognitive performance and relationship satisfaction from a dyadic perspective, i.e., it was analyzed to what extent dyadic constructs (dyadic cognition, dyadic coping) were related to these variables.

This thesis has emphasized the idea that older, long-term married couples are able to, if necessary, compensate for individual deficits by collaborating successfully with the partner and by forming their dyadic interactions in a way to assure their relationship satisfaction and their

well-being. However, it would be wrong to conclude that social support between partners is always only positive. There are studies suggesting that receiving support from the partner might be associated with higher relationship satisfaction, but not with a higher level of well-being (Knoll, Schulz & Schwarzer, 2006). Whereas receiving social support from the partner might damage one's self-worth, draws additional attention to problems, and reduces autonomy (in case of over-protection), giving support is usually more rewarding and accordingly associated with higher levels of well-being, health, and relationship satisfaction (Schwarzer & Knoll, 2007). Especially in the context of older adults where autonomy loss and low self-confidence can already be a consequence of the normal aging process, the right amount of support from the spouse seems to be particularly important. Similarly, in the context of dyadic cognition, it seems plausible that even if the collaboration outcome is positive, some partners might experience the collaborative process as intimidating or self-worth threatening.

The role of *reciprocal* social support (cf. Walster et al., 1978) becomes particularly evident in couples confronted with a severe illness like dementia, where a balanced exchange is no longer possible (study 4). In study 3 it is shown that support-reciprocity is highly associated with relationship satisfaction and several other studies have shown that a lack of reciprocity is associated with conflicts in social relationships (Smith, 1992; cited in Kruse & Wahl, 1999). However, there also exist stable relationships that seem highly "unbalanced" at first glance (for example when one partner suffers from dementia). One explanation for the phenomenon that such relationships can also function, might be that in close social relationships there is usually a so called "support bank". This means that in case of an imbalance of support at a certain point in a relationship, partners also consider support provided in the past (Kahn & Antonucci, 1980). Received and given social support in the past can therefore protect social relationships (not only couples) from the negative effects of a lack of actual reciprocity. Concerning study 4 this means on the one hand that caregivers might not mind to provide more support than they receive and on the other hand that caregivers have to adapt carefully to the needs of the partner and not provide too much help. Another idea is that people compensate a lack of reciprocity in a relationship by engaging in other relationships and therefore reach a personally satisfying balance over all their social relationships. In the above example this would mean that caregivers would try to get more support from other social partners.

Another important aspect of spousal social support is the question if wives and husbands have different conceptions of support and act differently when engaging in support behaviors (the question only arises when looking at heterosexual couples, which is the case in almost all studies on marriages in old age). In study 3 it was pointed out that older wives reported more stress communication and more negative dyadic coping of the partner. Other studies (for example Acitelli & Antonucci, 1994) discuss that spousal social support in the sense of dyadic coping is primarily associated with older wives' relationship satisfaction and well-being and that husbands' relationship satisfaction depends more on factor such as marital status (Goves, Hughes, & Style, 1983; Hess & Soldo, 1985), friends' support (Julien & Markman, 1991), and work context (Billings & Moos, 1982). Regarding gender differences in dyadic cognition, in study 1 it was described that men can be more influential in the collaborative process, even if individually they perform worse than their wives (Margrett & Marsiske, 2002). Whereas gender differences in collaboration were not analyzed in study 2, a follow-up study with the same task (Bauert, 2009) showed that husbands' communication during dyadic problem solving was more controlling and collaborative (direct influence) and wives' communication style was described as more indirect, i.e., they showed more withdrawal and more affiliative behaviors (cf. Leaper, 1991). Future research should further address the topic of spousal social support in old age and analyze in detail what kind of support, in what situations, is associated with what kind of outcome.

Even though this thesis shows the importance of spousal social support in the sense of dyadic interactions for cognitive performance and relationship satisfaction in old age, there are also other factors that influence these variables and the coping as well as the collaborative process itself. It was shown that dyadic cognition can influence cognitive performance positively, but of course cognitive performance in old age also strongly depends on other factors (see Martin & Kliegel, 2008). Concerning dyadic cognition, process variables such as communication should get additional attention (see chapter 6.1.2. for further research implications).

In the context of relationship satisfaction, the role of other interpersonal processes should also be mentioned here. Cognitive factors, such as attributions or interpretations of partner behaviors and lay theories about relationships, emotions (for example negative affect), physiology (hormones, heart rate), and violence are aspects that have received attention in the

literature on determinants of marital satisfaction of (mostly) young couples (Bradbury et al., 2000). The influence of context variables such as the presence of children (having young children has the paradoxical effect of increasing marital stability and at the same time decreasing marital satisfaction), spouses' background (attachment, parental divorce), and spouses' personality on relationship satisfaction have also been analyzed. Concerning the association between personality and relationship satisfaction empirical findings suggest a negative correlation between neuroticism and marital satisfaction in younger and middle aged adults (for example Davila, Karney, Hall, & Bradbury, 2003, cited in Schmitt et al., 2007). A combination of these results with findings that show systematic age differences and age-related changes in the mean-levels of personality traits across the lifespan into old age (Allemand, Zimprich, & Hendriks, 2008; Allemand, Zimprich, & Martin, 2008; Roberts, Walton, & Viechtbauer, 2006) points out the importance of looking at interaction effects of personality development, relationship satisfaction and age. The general picture that envinced from both cross-sectional and longitudinal personality research suggests that individuals particularly in early adulthood tend to increase in social desirable traits such as Agreeableness and Conscientiousness, and to decrease in Neuroticism (cf. Roberts, Walton, & Viechtbauer, 2006), which could have a positive effect on older adults marital satisfaction. Even more importantly, by demonstrating that older spousal partners' conscientiousness was associated with the other spouse's physical functioning, Roberts, Smith, Jackson, and Edmonds (2009) show the importance of a dyadic perspective when analyzing spousal behavior.

Overall it can be concluded that in aging as well as in marriage research, it is important to include a dyadic perspective. In this thesis it was shown that dyadic interactions are associated with cognitive performance and relationship satisfaction and for example Hoppmann (2009) showed in a longitudinal study with long-term older married couples that there exist sizeable spousal similarities not only in levels of life satisfaction, but also in how life satisfaction changes over time. These results demonstrate that certain behaviors and developments over the lifespan can be explained more accurately when a dyadic perspective is considered. With the idea in mind that satisfying close relationships constitute the very best thing in life and that there is nothing people consider more meaningful and essential to their well-being (cf. Berscheid and Reis, 1998), further research, considering the aspects mentioned in this chapter, is needed in order to obtain a more complete picture on the development of spousal relationships over the lifespan.

7 References

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Curriculum Vitae

Education

2006 – 2010	University of Zurich, Department of Psychology Doctoral candidate
1998 – 2005	University of Fribourg, Department of Psychology Diploma (Licentiate) in psychology
2003 – 2005	University of Bern, Department of Psychology Study of psychopathology
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Employment

Since 2006	University of Zurich, Department of Psychology Research assistant